JAMES WATT,

From an Original Painting

Published by [illegible]

THE

LONDON

MECHANICS' REGISTER.

"With thee, serene PHILOSOPHY! with thee,
"And thy bright garland, let me crown my song!
"Without thee, what were unenlightened man?
"A savage, roaming through the woods and wilds,
"Rough clad; devoid of every finer art
"And elegance of life. Nor social bliss,
"Nor guardian law, were his; nor various skill
"To turn the furrow, or to guide the tool
"Mechanic." THOMSON.

VOLUME SECOND.

London:
PUBLISHED BY GIFFORD AND CO.
PATERNOSTER ROW.
AND J. T. SMITH AND CO. EDINBURGH.
M.DCCC.XXV.

Cowie and Strange, Printers, 24 Fetter Lane

PREFACE.

Amongst the distinguishing features which characterize the present state of society, the most striking and the most gratifying is the universal thirst for knowledge, so pre-eminently conspicuous in that numerous and important class of individuals, to whom, till within a few years, the stores of literature were almost inaccessible. Hitherto, the humble MECHANIC has witnessed the effects produced by his manual exertions, without inquiring into the principles upon which his operations depended; or, if his curiosity has been occasionally awakened to an investigation of the philosophical facts connected with his occupation, his intention has been frustrated, and his researches have ended in disappointment, from the want of that scientific instruction which could alone conduct his inquiries to a satisfactory result. Happily for this country, the mist that has so long shrouded the latent talent of the "OPERATIVE ARTISAN" is at length dispelled, and the establishment of MECHANICS' INSTITUTIONS has given an irresistible impetus to those mental energies, of the very existence of which he was almost unconscious.

To the diffusion of knowledge thus effected by the admirable Institutions to which we have adverted, the circulation of literary and scientific information, through the medium of cheap periodical publications, has operated as a powerful auxiliary. And if, in this department of public utility, the pages of the LONDON MECHANICS' REGISTER have co-operated in promoting that vast regeneration of intellect, which every day's experience renders more obvious, our labors will not have been in vain, and we shall need no additional motive for unremitted and increased exertions.

That our little work has contributed, in no inconsiderable degree, to this great intellectual elevation, the flattering testimonials we continue to receive afford ample evidence; and we trust, that without incurring the imputation of egotism, we may venture to appeal to the contents of our SECOND VOLUME as a proof that these encouraging tributes of approbation are not entirely unmerited.

In addition to a variety of communications on subjects highly interesting to the mechanical world, the valuable Lectures delivered to the

PREFACE.

Members of the LONDON MECHANICS' INSTITUTION, comprehending in succession all the most important facts, and many of the best established Doctrines, connected with every branch of Natural and Experimental Philosophy, have been transferred to our pages with a solicitous attention to accuracy; and the Volume now submitted to the Public contains clear and intelligible illustrations of the Sciences of ASTRONOMY, CHEMISTRY, ELECTRICITY, ELECTRO-MAGNETISM, PNEUMATICS, HYDROSTATICS, &c. with a complete History and Description of that amazing monument of mechanical genius, the STEAM-ENGINE. The estimation in which this part of our Work is held, may be appreciated from the fact, that the Lectures at the LONDON MECHANICS' INSTITUTION, as reported in the MECHANICS' REGISTER, are regularly read to the Members of several provincial Institutions, where the funds are at present too limited to defray the expense of Lecturers.

To the numerous Correspondents who have afforded us the assistance of their talents, we are happy to offer our cordial acknowledgments; and we should be wanting in gratitude if we omitted, upon this occasion, to express a deep sense of obligation to the kindness of our distinguished correspondent, Dr. BIRKBECK, who has enriched our pages with communications which would stamp additional importance on the most valuable scientific publications of the age.

Sensible that our miscellany is susceptible of much improvement, we shall always feel great pleasure in paying the most respectful attention to any practicable suggestions that may tend to enhance its value; and though we cannot indulge a hope of realizing the chimeras of those dictatorial hyper-critics, who expect that we should attain perfection at a single bound, we feel assured that our liberal-minded friends will honor our humble efforts with their approbation when it is merited, and judge with leniency of those instances of failure, which it is difficult to avoid at all times in the conduct of a miscellaneous work.

In conclusion, we beg to renew our warmest thanks to the Public for the very extensive and increasing patronage with which the MECHANICS' REGISTER has been honored; and to assure our Subscribers that no relaxation shall take place in our endeavors to merit the preference which it has obtained over its numerous competitors in the field of sci-

21st October, 1825.

BIOGRAPHICAL MEMOIR

OF

MR. JAMES WATT.

There is no class of individuals to whom the biography of the distinguished subject of the present Memoir can be indifferent or uninteresting, for in the benefits which his astonishing exertions have bestowed upon mankind, the humblest, as well as the most exalted, participates But though the beneficial effects of his great discoveries are felt and acknowledged by all ranks of society, from the regal possessor of the palace to the lowly inmate of the peasant's cottage, it is on the mind of the mechanic that his brilliant example is calculated to operate with the most powerful influence, because, while contemplating the splendid career of this "modern Archimedes," the emulation of the artizan is excited by the reflection that JAMES WATT was himself an '*operative Mechanic*.' The steps by which he advanced from comparative obscurity to affluence and eminence, solely by the efforts of his own genius, are therefore traced with increased interest, by those whose pursuits in some measure identify them with the great benefactor of his country and of the world Mr WATT's surprising improvements in the Steam Engine were effected by the application of scientific knowledge to mechanical ingenuity, and it is impossible for the contemplative mind to ponder upon this important fact, without a feeling of exultation, that in the present improved state of society, the volume of Science is unfolded to the perusal of the most humble aspirant after knowledge

The life of Mr Watt is of considerable importance in another point of view, as it affords a striking exception, among many others which might be adduced, to the prevailing impression that great talents are inadequately appreciated by the world "To the mechanic," said Dr BIRKBECK in his excellent lectures on the Steam Engine, "it is of vital importance to prove, by an example at once splendid and indisputable, that to genius,—useful and substantial genius,—the world can do justice, that with the highest description of mechanical talent, the highest degree of moral excellence may be combined, and that while gain, and even grandeur, are flowing from the successful exercise of the MECHANIC ARTS, intellectual cultivation may be ardently pursued, along with the extensive enjoyment of all the kind, the social, and the virtuous feelings —feelings which whilst they adorn our nature, shed around mortal existence its brightest charms and its most exquisite blessings. The genius, the character and the posthumous reputation of JAMES WATT must conspire, when attentively surveyed, to rouse the keenest spirit of emulation, and we cannot therefore be too often prompted, 'to consider his ways and be wise.'

Mr. James Watt was born at Greenock, in the year 1736. He was descended from highly respectable, though not affluent parents, his father having been a merchant and one of the bailies, or magistrates of that town, and his education at the public schools was superintended with parental assiduity. His grandfather and uncle were both respectable mathematicians, and the latter was author of a survey of the River Clyde.

From his infancy, Mr. Watt's constitution was of the most delicate kind, and to this may be attributed those retiring and studious habits, which were so remarkable during the whole period of his long and distinguished life. In his early days, young Watt was considered as a reserved lad, often separating himself from the companions of his youth, and devoting many of those hours to the improvement of his mind, which by others were dissipated in childish sports. He was not, however, wanting in sociability, but frequently entered into all the amusements of his school fellows, ever assuming a will of his own, when any matter in dispute led him to exert that high spirit of independence, which so steadily marked his subsequent character and conduct.

Having finished his grammatical studies, and laid a solid foundation in the several branches of useful and important knowledge, he was, at the age of sixteen, articled as an apprentice to learn the art of "an instrument-maker," a sort of business of which we have little idea in the metropolis of the United Kingdom, and indeed which is not now common even in Glasgow, or other large towns either in north or south Britain. At that period the profession included the making and repairing of the instruments used in experiments in mechanics and natural philosophy, and the manufacture, in a rough way, of all kinds of musical instruments, and of theodolites, quadrants, and other instruments necessary for the practice of land surveying.

It will perhaps be thought that an apprenticeship to a profession which included the knowledge of so many things was not propitious to the rising talents of a young man of genius, whose mind would be more likely to be diverted and distracted by many objects than seriously bent to the acquirement of one, which should of itself lay the foundation of his future fame. There are, however, advantages, which attach themselves to situations of this kind, since the inventive powers are called forth, and young men have frequent opportunities of conversing with persons of talent and genius, who require the assistance of mechanics, either in the repair or alteration of those machines devoted to experiment or discovery.

In Scotland three years are considered as sufficient in every respect to learn a trade, and, if young people are not bound apprentices for the sake of obtaining certain privileges, they are rarely articled for a longer term. In professions of no great difficulty this period will be amply sufficient, and will afford the youth two or three extra years, which may be dedicated to the acquirement of school-learning.

When Mr. Watt had completed the term of his apprenticeship, he came to London, and worked about a year with a mathematical instrument maker in the regular line of trade. During this period he acquired readier methods of dispatching business, but sitting in winter near the door of the workshop, he caught a severe cold, the effect of which he felt, at times, for many years afterwards.

Having remained but little more than twelve months in the metropolis, Mr. Watt returned to his native country, where he commenced a business of the same sort as that to which he had been brought up, uniting the several arts of mathematical and musical instrument maker with those of measuring and land surveying. Although no great sums

were to be gained by such pursuits in Scotland, yet, wherever there was business requiring such a diversity of talents, the remuneration must have been adequate to keep a man from want, and, accordingly, Mr Watt acquired at this period, not only a comfortable subsistence but what was sufficient also to enable him to pursue a course of experiments on which his active mind was bent.

While he was in this situation, one of those fortunate accidents took place, which frequently call into action the talents of great minds, and which bring into deserved notice modest and obscure worth.

The professor who lectured on natural philosophy at the university of Glasgow, had occasion to apply to Mr Watt, to repair the model of a steam engine, which by length of time, had become unfit for exhibiting to the students the powerful effects of steam. The mind of the artist was struck with the contrivance of the engine and instantly perceived defects, which he felt himself equal to remedy, and contemplated improvements which would render it more generally subservient to the uses of society. From this hour, though he still continued his former profession, his whole attention was fixed upon the improvement of the STEAM ENGINE every other object was subordinate, every other pursuit was followed merely for the sake of subsistence only but the steam engine was to lay the foundation of his future fame and fortune.

It is unnecessary for us here to trace the origin of this important engine, from the first application of steam as a *prime mover* by Hero of Alexandria, upwards of 2000 years ago, or to enumerate the various improvements made in its construction from that remote period to the time when the Atmospheric Engine was invented by Newcomen about the year 170 Our readers will find this task ably executed by Mr PARTINGTON in his lectures delivered to the members of the London Mechanics' Institution, and we therefore refer them to the reports of those lectures contained in the present volume,* in which they will find every essential particular connected with this vast mechanical agent illustrated with numerous diagrams explanatory of its operation and powers. It will be sufficient to state that the model above alluded to, which was entrusted to Mr Watt to repair for the University of Glasgow was constructed upon the principle of Newcomen's Atmospheric Steam Engine. Many important improvements had at this period, been made in the Steam Engine, but the great obstacle to its extensive use was the prodigious expenditure of coals, as it was calculated that a large engine working night and day consumed at the rate of nearly 4000 chaldrons of coals in a year.

A thousand fruitless attempts were made to reduce this consumption. Every engineer had his own device in the construction of his furnace, but after all their attempts, the real improvement were of no material advantage. Science was not sufficiently developed. Dr Black's discovery of *latent* heat shewed the way of estimating the relation that subsisted between the heat expended and the quantity of steam produced. This was about the year 1763, and at the precise period when Mr Watt was called upon to repair the model of the Steam Engine to which we have before referred. He had been a pupil to the celebrated lecturer in chemistry, had imbibed his spirit and had formed an intimate acquaintance with him.

While Mr Watt was directing his attention to fitting up the model of Newcomen's engine a variety of curious facts occurred to him, relative to the production and condensation of steam, among others, that remarkable fact which was ever after appealed

* Vide page [illegible]

to by Dr. Black, as a proof of the immense quantity of heat which is contained in a small quantity of water in the form of elastic steam When a quantity of water is heated several degrees above the boiling point in a close digester, if a hole be suddenly opened the steam rushes out with prodigious violence and the heat of the remaining water is reduced, in the course of only two or three seconds to the boiling temperature The water of the steam which has issued, amounts, perhaps, to but a few drops and yet these have carried off with them the whole excess of heat from the water in the digester

Since then a small quantity of steam contains so great a quantity of heat, it must expend a great quantity of fuel, nor can it be prevented by any construction of the furnace Mr Watt readily saw this and endeavoured to find out methods of husbanding heat He soon discovered that not less than three or four times the quantity of steam was wasted in comparison of that which went to the working of the machine He made many attempts to diminish this waste which were sufficient to convince him that no real and effectual saving could be obtained so long as the condensation was performed in the cylinder He attempted it in another place, the experiment was conducted on the simplest plan, and it succeeded beyond his most sanguine expectations He repeated it in a more accurate manner, the condensation was so rapid, that he could scarcely measure the time taken up in the performance of it The vacuum in the cylinder was according to the hopes he had indulged almost perfect

Having gained his capital point, Mr Watt found many difficulties to struggle with The water produced by the condensed steam, and the air extricated from it required pumps to extract them, which at length he contrived to work by the great beam

During the progress of these improvements Mr Watt made many experiments on the quantity and density of the steam of boiling water By these he was convinced that although he had greatly diminished the waste of steam a great deal yet remained to be done, and that the steam expended during the rise of the piston, was at least three times more than would fill the cylinder Mr Watt s fertile genius immediately suggested to him the expedient of employing the elasticity of the steam from the boiler to impel the piston down the cylinder, in place of the pressure of the atmosphere; and by this improvement, he restored the engine to its first principles, making it *an engine really moved by steam*, and not by air.

When a person skilled in mechanics and chemistry reviews the different forms of Mr. Watt's Steam Engines, he will readily perceive, that they are susceptible of a great variety of shapes, in which the distinguishing improvements may be employed The first great improvement was the condensation in a separate vessel This increased the original powers of the engine and greatly diminished the waste of steam The next improvement, by employing the elastic pressure of the steam, instead of that of the atmosphere, aimed not only at a still farther diminution of the waste, but was fertile in advantages, rendering the machine more manageable and enabling the operator to suit the power of the engine to its work, in almost any given proportion; and the third improvement renders it as uniform in its action as any water wheel

Mr Watt had been appointed, as early as 1757, when he was only in his 21st year, to the situation of mathematical instrument maker to the University of Glasgow, and had apartments assigned to him in the College where he resided till the year 1764, when he married his maternal cousin, Miss Miller, who died in 1773, leaving a daughter and a son At the period of his marriage, he removed from the College to the town of Glasgow, and in the prosecution of his improvements on the Steam Engine, he was at first

associated with Dr Roebuck, a gentleman who possessed a small fortune and considerable merit, but their means were inadequate to so vast an undertaking, and a failure was the consequence In this situation was superior genius struggling, when the celebrated Mr. Boulton, of Soho, near Birmingham, in the year 1773, became acquainted with the business His knowledge of mechanics enabled him to appreciate the invention, and the spirit of enterprize and the fortune he possessed induced him to engage in it with ardour. Dr. Roebuck was reimbursed with ample interest, and Mr Watt, having lost his wife, immediately settled at Birmingham, and was indefatigable in bringing to perfection and extending the sale of his engines

A more fortunate conjunction could not have been imagined The union of two such men as Watt and Boulton was equal to any enterprize They were both celebrated for highly cultivated and liberal minds, both indefatigable in business, the latter was in possession of money to carry any scheme into effect, while, in the mind of the former, resources and expedients were found sufficient to overcome every difficulty with which their projects might be embarrassed

An act of parliament was obtained to prolong the patent, which had nearly expired in making experiments at an enormous expenditure. Parliament, faithful to the trust reposed in it prolonged, without difficulty, the exclusive privilege for twenty-five years, which expired with the last century.

The mode by which a revenue was drawn by the patentees was singularly ingenious, as well as founded upon the most liberal principles. A great number of experiments were set on foot, in the presence of men of knowledge and undoubted honour and veracity, to ascertain what was the saving of fuel in performing the same quantity of work with the new engine, compared with what was used in the old one

The dimensions of the cylinder and number of strokes were taken, as the measure of the work done so that *counting* machines, fixed to the engine were contrived to number every stroke taken and at the end of certain periods these were opened, in the presence of the parties interested, the quantity of work ascertained, and the savings calculated, one-third of which was paid to the inventors while the remaining two-thirds were clear gain to the proprietors Upon a single mine in Cornwall, the annual revenue claimed by Messrs Boulton and Watt, upon three engines, was 2,400l, consequently the saving to the proprietors of that mine were but little short of 5000l per annum, while, to the country at large there was a saving of fuel equal in value to more than 7 000l a year

It has been estimated by those who have gone into the detail of the business, and who have made their calculations on sure principles, that steam engines are to the nation at large a saving of 75,000l per day An invention so important, combining so many advantages and attended with so much individual and national profit, is of itself sufficient to immortalize the genius and superior talents of the great mechanic who brought it to perfection

Soon after Mr Watt had settled at Birmingham, he married a second wife, Miss Mary M'Gregor of Glasgow, by whom he had two children, who both died in their infancy He had also the misfortune to see his daughter by his first wife go before him to the grave, after presenting him with two grandchildren His son, who was long associated with him in his business and in his studies, has been for many years in partnership with the son of Mr. Boulton, at the head of the great establishment formed by their fathers at Soho, and which is at present known in every quarter of the world

From the period when Mr. Watt entered into partnership with Mr. Boulton, the even-

tenor of his active and valuable life affords little scope for the biographer. Exempt from the vicissitudes of fortune, he enjoyed the honorable reward of his extraordinary talents, and possessing ample means of realizing the conceptions of his genius, he pursued his discoveries with unabated ardour during many years of uninterrupted prosperity. The persevering activity with which he devoted all the energies of his powerful mind to the various objects of his researches, even to the latest period of his existence, is ably and eloquently displayed in the following tribute to his memory, which was written soon after his decease by FRANCIS JEFFREY, Esq. To this affecting and energetic record of his public and private character and of the calm and tranquil manner in which he breathed his spirit into the hands of His Creator, we request the particular attention of our readers.

"Death is still busy in our high places. And it is with great pain that we find ourselves called upon so soon after the loss of Mr Playfair, to record the decease of another of our illustrious countrymen, and one to whom mankind has been still more largely indebted. Mr James Watt, the great improver of the steam engine, died on the 25th of August, at his seat at Heathfield near Birmingham, in the 84th year of his age.

"This name fortunately needs no commemoration of ours, for he that bore it survived to see it crowned with undisputed and unenvied honours, and many generations will probably pass away before it shall have gathered 'all its fame.' We have said that Mr Watt was the great *improver* of the steam engine, but, in truth, as to all that is admirable in its structure, or vast in its utility, he should rather be described as its *inventor*. It was by his inventions that its action was regulated so as to make it capable of being applied to the finest and most delicate manufactures, and its power so increased as to set weight and solidity at defiance. By his admirable contrivances, it has become a thing stupendous alike for its force and its flexibility,—for the prodigious power which it can exert, and the ease, and precision and ductility, with which it can be varied, distributed and applied. The trunk of an elephant that can pick up a pin or rend an oak, is as nothing to it. It can engrave a seal, and crush masses of obdurate metal before it, draw out, without breaking, a thread as fine as gossamer, and lift up a ship of war like a bauble in the air. It can embroider muslin and forge anchors, cut steel into ribbands, and impel loaded vessels against the fury of the winds and waves.

"It would be difficult to estimate the value of the benefits which these inventions have conferred upon the country. There is no branch of industry that has not been indebted to them, and in all the most material they have not only widened most magnificently the field of its exertions, but multiplied a thousand-fold the amount of its productions. It is our improved steam engine that has fought the battles of Europe, and exalted and sustained, through the late tremendous contest, the political greatness of our land. It is the same great power which now enables us to pay the interest of our debt and to maintain the arduous struggle in which we are still engaged with the skill and capital of countries less oppressed with taxation. But these are poor and narrow views of its importance. It has increased indefinitely the mass of human comforts and enjoyments, and rendered cheap and accessible all over the world the materials of wealth and prosperity. It has armed the feeble hand of man, in short, with a power to which no limits can be assigned, completed the dominion of mind over the most refractory qualities of matter, and laid a sure foundation for all those future miracles of mechanic power which are to aid and reward the labours of after generations. It is to the genius of one man too that all this is mainly owing, and certainly no man ever before bestowed such a gift on his kind.

This blessing is not only universal, but unbounded; and the fabled inventors of the plough and the loom, who are deified by the erring gratitude of their rude contemporaries, conferred less important benefits on mankind than the inventor of our present steam-engine.

"This will be the fame of Watt with future generations; and it is sufficient for his race and his country. But to those to whom he more immediately belonged, who lived in his society and enjoyed his conversation, it is not, perhaps, the character in which he will be most frequently recalled—most deeply lamented—or even most highly admired. Independently of his great train of attainments in mechanics, Mr Watt was an extraordinary, and in many respects a wonderful man. Perhaps no individual in his age possessed so much and such varied and exact information,—had read so much, or remembered what he had read so accurately and well. He had infinite quickness of apprehension, a prodigious memory, and a certain rectifying and methodizing power of understanding, which extracted something precious out of all that was presented to it. His stores of miscellaneous knowledge were immense,—and yet less astonishing than the command which he had at all times over them. It seemed as if every subject that was casually started in conversation with him, had been that which he had been last occupied in studying and exhausting; such was the copiousness, the precision, and the admirable clearness of the information which he poured out upon it without effort or hesitation. Nor was this promptitude and compass of knowledge confined in any degree to the studies connected with his ordinary pursuits. That he should have been minutely and extensively skilled in chemistry and the arts, and in most of the branches of physical science, might perhaps have been conjectured; but it could not have been inferred from his usual occupations, and probably is not generally known, that he was curiously learned in many branches of antiquity, metaphysics, medicine, and etymology; and perfectly at home in all the details of architecture, music, and law. He was well acquainted too with most of the modern languages, and familiar with their most recent literature. Nor was it at all extraordinary to hear the great mechanician and engineer detailing and expounding, for hours together, the metaphysical theories of the German logicians, or criticising the measures or the matter of German poetry.

In his temper and dispositions he was not only kind and affectionate, but generous and considerate of the feelings of all around him; and gave the most liberal assistance and encouragement to all young persons who showed any indications of talent, or applied to him for patronage or advice. His health, which was delicate from his youth upwards, seemed to become firmer as he advanced in years. His friends in this part of the country never saw him more full of intellectual vigour and colloquial animation,—never more delightful or more instructive,—than in his last visit to Scotland, in the autumn of 1817. Indeed, it was after that time that he applied himself, with all the ardour of early life, to the invention of a machine for mechanically copying all sorts of sculpture and statuary; and distributed among his friends some of its earliest performances, as the productions of a young artist just entering on his 83d year.

This happy and useful life came at last to a gentle close. He had suffered some inconvenience through the summer of 1819, but was not seriously indisposed till within a few weeks of his death. He then became perfectly aware of the event which was approaching, and preserving his accustomed tranquillity and benevolence to the last, seemed only anxious to point out to the friends around him the many sources of consolation afforded by the circumstances under which it was about to take place. He w-

pressed his sincere gratitude to Providence for the length of days he had been blessed with, and the exemption he had enjoyed from most of the infirmities of age, as well as for the calm and cheerful evening with which he had been permitted to close his life, after the virtuous labours of a long day had been concluded. Full of years and honours, in calmness and tranquillity, he yielded up his soul without a pang or struggle, and passed from the bosom of his family to that of his God."

After the preceding sketch of the life of this truly illustrious individual, it only remains for us to give some account of the Public Meeting which was held at the Freemason's Tavern, on the 18th of June, 1824, for the purpose of opening a subscription for the erection of a monument to his memory.

Many of the friends and admirers of the late Mr. Watt had long regretted that no tribute of national gratitude had been paid to a man whose inventions had so essentially promoted the prosperity and increased the resources of the British empire, and whose talents and discoveries as a philosopher were universally allowed, both at home and abroad, to have conferred honour upon his country.

Those feelings were strengthened by the recent exhibition of his statue by Chantrey; not more admirable as an exquisite work of art, than as a striking and characteristic resemblance; and by the appearance, nearly at the same time, of an interesting, though brief memoir of his life, in the last volume of the Encyclopedia Britannica, to which the above beautiful delineation of his character by Mr Jeffrey was subjoined. Time and reflection had contributed to enhance their estimate of Mr. Watt's extraordinary merits, while the beneficial effects of his inventions were every day becoming more and more conspicuous in all parts of the civilized world.

It was known that the statue was intended by the present Mr. Watt to be placed over his father's remains in the parish church of Handsworth, in Staffordshire; and that another statue, for which that gentleman had engaged the same great artist, was designed by him to be presented to the university and city of Glasgow, as a mark of respect to the place where his father's talents had been first encouraged, and where his great improvement in the principle of the Steam-Engine had been made. But the friends of Mr. Watt were decidedly of opinion that it should not be left to filial piety alone to commemorate genius and talents from which the whole community had derived such signal benefits; and they, in consequence, formed the resolution of erecting an appropriate memorial in the metropolis of the British empire, by private subscription among themselves. They could not, however, divest themselves of the conviction that Mr. Watt had peculiar and indubitable claims to the highest honours that are ever conferred by government on men who have deserved well of their country; and under this persuasion, they considered it right to make application to his Majesty's ministers to sanction a vote of parliament for the erection of a suitable monument, either in Westminster Abbey or in St. Paul's Cathedral.

To this application a prompt and willing attention was given by the leading members of administration. It appeared to accord with their own wishes and opinions; and expectations were for some time entertained of its being carried into effect. But no precedent could be discovered for such a measure, and ministers felt great difficulty in establishing one which might eventually place them under the painful and invidious necessity of discussing the merits of other eminent men, for whom claims might be brought forward. In intimating this difficulty, they at the same time announced the high sense which his Majesty entertained of the merits and public services of Mr. Watt.

and his gracious desire to contribute a large sum towards the erection of a monument by public subscription. Ministers likewise expressed their own individual wishes to take a prominent part in the execution of such a plan; which supported, as they were convinced it would be, by the general concurrence of the country, would become a national tribute to Mr. Watt's merits, and a durable record of the public gratitude.

To a proposal so honourable to the memory of Mr. Watt, his friends gave a ready and cordial assent, and as the session of parliament was drawing to a close, and many of its members most friendly to the measure were leaving town, it was resolved to call a public meeting in London, to be held as speedily as circumstances would admit. A notice was accordingly inserted in the newspapers, and addressed by circular to those gentlemen who were presumed likely to take an interest in the proceedings. The unavoidable shortness of time prevented the attendance of many warm friends of Mr. Watt from distant parts of the kingdom—yet it may truly be said, that a meeting more distinguished by rank, station, and talent, was never before assembled to do honour to genius, and to modest and retiring worth; and that a more spontaneous, noble, and discriminating testimony was never borne to the virtues, talents, and public services of any individual in any age or country.

The chair was taken by the Earl of Liverpool, the Prime Minister of England, who was expressly deputed by his Majesty for that purpose. His Lordship opened the important business of the meeting in an eloquent speech, which he concluded by stating that his Majesty had authorised him to put down £500 as his subscription towards the proposed monument.

Sir Humphry Davy, President of the Royal Society, then moved the First Resolution in the following terms:—

I ought to apologise for rising so immediately to address this meeting, but as the distinguished person whose memory we have met together to honour, owes his claims to the gratitude of society to his scientific labours, and as he was one of the most illustrious Fellows of that institution for the promotion of natural knowledge over which I have the honour to preside, I consider it as a duty incumbent on me to endeavour to set forth his peculiar and exalted merits, which live in the recollection of his contemporaries, and will transmit his name with immortal glory to posterity. Those who consider James Watt only as a great practical mechanic form a very erroneous idea of his character: he was equally distinguished as a natural philosopher and a chemist, and his inventions demonstrate his profound knowledge of those sciences, and that peculiar characteristic of genius, the union of them for practical application. The Steam-Engine before his time was a rude machine, the result of simple experiments on the compression of the atmosphere, and the condensation of steam. Mr. Watt's improvements were not produced by accidental circumstances, or by a single ingenious thought; they were founded on delicate and refined experiments, connected with the discoveries of Dr. Black. He had to investigate the cause of the cold produced by evaporation, of the heat occasioned by the condensation of steam—to determine the source of the air appearing when water was acted upon by an exhausting power: the ratio of the volume of steam to its generating water, and the law by which the elasticity of steam increased with the temperature: labour, time, numerous and difficult experiments, were required for the ultimate result; and when his principle was obtained, the application of it to produce the movement of machinery demanded a new species of intellectual and experimental labour. He engaged in this with all the ardour that success inspires, and was obliged to bring

all the mechanical powers into play, and all the resources of his own fertile mind into exertion; he had to convert rectilineal into rotatory motion, and to invent parallel motion. After years of intense labour, he obtained what he wished for: and at last, by the regulating centrifugal force of the *governor*, placed the machine entirely under the power of the mechanic, and gave perfection to a series of combinations unrivalled for the genius and sagacity displayed in their invention, and for the new power they have given to civilized man. Upon the nature of this power I can hardly venture to speak; so extensive and magnificent a subject demands a more accomplished and able orator. What is written on the monument of another illustrious and kindred philosopher in relation to one great work, and a single spot, will apply to Watt in almost every part of the empire:—

'Si monumentum requiris, circumspice!'

And where can we cast our eyes, without seeing results dependent upon or connected with his invention?—Look round the metropolis, our towns—even our villages, our dock-yards, and our manufactories, examine the subterraneous cavities below the surface, and the works above, contemplate our rivers and our canals, and the seas which surround our shores, and every where will be found records of the eternal benefits conferred on us by this great man. Our mines are drained, their products collected, the materials for our bridges raised, the piles for their foundations sunk by the same power; machinery of every kind, which formerly required an immensity of human labour, is now easily moved by steam, and a force equal to that of five hundred men is commanded by an infant, whose single hand governs the grandest operations. The most laborious works, such as sawing of stones and wood, and raising of water, are effected by the same means, which produce the most minute, ornamental, and elegant forms. The anchor is forged, the die is struck, the metal polished, the toy modelled by this stupendous and universally applicable power; and the same giant arms twist the cable rope, the protector of the largest ship of the line, and spin the gossamer like threads which are to ornament female beauty. Not only have new arts and new resources been provided for civilised man by these grand results, but even the elements have to a certain extent been subdued and made subservient to his uses; and, by a kind of philosophical magic, the ship moves rapidly on the calm ocean, makes way against the most powerful stream, and secures her course, and reaches her destination even though opposed by tide and storm.

The Archimedes of the ancient world by his mechanical inventions arrested the course of the Romans, and stayed for a time the downfall of his country. How much more has our modern Archimedes done? He has permanently elevated the strength and wealth of this great empire; and during the last long war, his inventions and their application were amongst the great means which enabled Britain to display power and resources so infinitely above what might have been expected from the numerical strength of her population. Archimedes valued principally abstract science; James Watt, on the contrary, brought every principle to some practical use, and, as it were, made science descend from heaven to earth. The great inventions of the Syracusan died with him;—those of our philosopher live, and their utility and importance are daily more felt; they are among the grand results which place civilised above savage man—which secure the triumph of intellect, and exalt genius and moral force over mere brutal strength, courage, and numbers. The memory of James Watt will live as long as civilised society

exists but it surely becomes us who have been improved by his labours—who have wondered at his talents, and respected his virtues, to offer some signal testimony of our admiration of this great man. This indeed cannot exalt his glory, but it may teach those who come after us, that we are not deficient in gratitude to so great and signal a benefactor. I therefore, my Lord, beg leave to move

"That the late James Watt, by the profound science and original genius displayed in his admirable inventions, has more than any other man of this age exemplified the practical utility of knowledge, enlarged the power of man over the external world, and both multiplied and diffused the conveniences and enjoyments of human life."

Our limits compel us reluctantly to confine ourselves to a brief notice of the remainder of the proceedings. The Resolution proposed by Sir HUMPHRY DAVY was seconded in an able speech by Mr Boulton, and the remainder of the Resolutions were introduced by Mr Huskisson, Mr Peel, Sir James Mackintosh, the Earl of Aberdeen, Mr Brougham, Mr Wilberforce, Mr Littleton, Mr Frankland Lewis, and other gentlemen distinguished by exalted rank and scientific attainments. The most perfect unanimity characterised the whole of the proceedings, and it was truly gratifying to observe that all political differences of opinion were absorbed in the grand object of perpetuating the memory of departed excellence.

Mr HUSKISSON, towards the close of the excellent speech with which he prefaced the second Resolution, introduced the following remarks:—"It has been often said, that many of the great discoveries in science are due to accident; but it was well remarked by the President of the Royal Society, that this cannot be the case with the principal discovery of Mr Watt. Long and scientific research and application alone could have enabled him to create his steam engine. Again, it has frequently happened that those philosophers, who have made brilliant and useful discoveries, by watching the phenomena of the physical world, the combinations of chemistry, or the mysterious workings of organic life, have only been able to turn their discoveries to the purpose of averting evils threatening, and often destroying, the precarious tenure of human existence. Thus Franklin disarmed the thunderbolt, and conducted it innocuous through our buildings, and close to our fire-sides—thus Jenner stripped a loathsome and destructive disease of its virulence, and rendered it harmless of devastation—thus the present President of the Royal Society (of whom it is difficult to say whether abstract science or practical life has been most benefited by his discoveries) sent the safety lamp into our mines to save (as its name implies) their useful inhabitants from the awful explosion of the fire damp. But the discovery of Mr Watt went further: he subdued and regulated the most terrific power in the universe, that power which, by the joint operation of pressure and heat, probably produces those tremendous convulsions of the earth, which in a moment subvert whole cities, and almost change the face of the inhabited globe. This apparently ungovernable power Mr. Watt brought into a state of such perfect organization and discipline (if I may use the expression) that it may now be safely manœuvred and brought into irresistible action, irresistible, but still regulated, measured, and ascertained, or lulled into the most complete and secure repose, at the will of man, and under the guidance of his feeble hand. Thus one man directs it into the bowels of the earth, to tear asunder its very elements, and bring to light its hidden treasures; another places it upon the surface of the waters, to control the winds of heaven, to stem the tides, to check the currents, and defy the waves of the ocean; a third, perhaps, and a fourth, are destined to apply this mighty power to other purposes,

still unthought of and unsuspected, but leading to consequences, possibly, not less important than those which it has already produced."

The Meeting terminated with a vote of thanks to the Earl of Liverpool, and a Committee, comprehending many of His Majesty's Ministers and of the most distinguished scientific individuals in the kingdom, was appointed to carry the Resolutions into effect.

We cannot more appropriately conclude this Memoir than in the words of Dr. BIRKBECK, who, in allusion to this meeting, introduced the following observations at the close of his Lectures on the Steam-Engine, delivered to the Members of the London Mechanics' Institution:—

"That I may not dwell too long upon this attractive topic, I shall conclude with the mention of one point of view, in which the character of Mr. Watt has been contemplated by my distinguished friend Mr. Brougham, at the meeting before alluded to. Whilst considering in what spot the monument which it had just been resolved should be erected, might be most appropriately placed, this indefatigable promoter of education and all the best interests of man exclaimed, 'where can the monument of Watt be more appropriately placed than in the temple of that religion which preaches peace to all and instruction to the poor? The temples of the Pagans have been adorned by statues of warriors who had dealt desolation on their race; but our's shall be graced with the statues of those, who have contributed to the triumph of humanity and science, and amongst others, of him, *who without giving sorrow to any man*, has achieved what has been an honour and a benefit to the human race.' Thus allow me to add, when hereafter, the names of many individuals, who have spread sorrow and desolation through disastrous nations, are heard only amidst the faint and feeble 'echoes of renown,' the name of Watt shall descend in triumph down the stream of time, age after age, gathering all its fame, and shall be pronounced, with universal reverberation, from the population of a happy, a prosperous, and a grateful world."

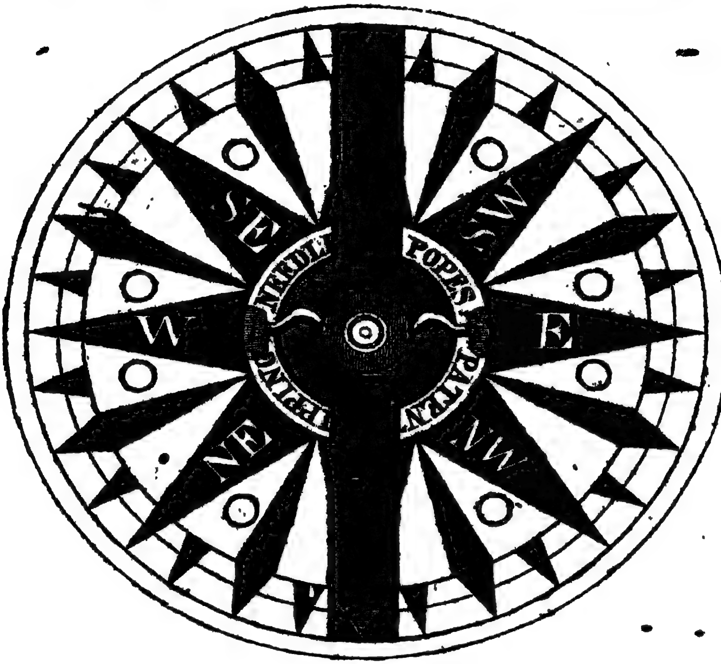
THE LONDON

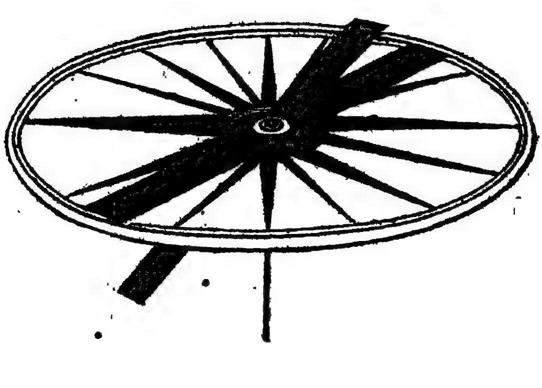
MECHANICS' REGISTER.

The watchful ruler of the helm no more,
With fixed attention, eyes th' adjacent shore;
But by the oracle of truth below,
The wondrous magnet, guides the wayward prow.—FALCONER.

No. 29.] SATURDAY, MAY 7, 1825. [Price 3d.

POPE's IMPROVED MARINER's COMPASS.





PATENT IMPROVED MARINER'S COMPASS, INVENTED BY MR. POPE, OF BALL ALLEY, LOMBARD STREET.

At the close of Dr. BIRKBECK's admirable Lecture on ELECTRO-MAGNETISM, delivered to the members of the London Mechanics' Institution, he introduced Mr. Pope's Steering Compass to the notice of his hearers, and spoke of its extraordinary merits in terms of high eulogium.* As this invention appears of great national importance, we are happy to present our readers with a more particular account of its advantages, which will be evident from an inspection of the engraving. Its great merit consists in suspending the magnetic needle in such a manner as to combine the advantages of the DIPPING NEEDLE with those of the ordinary Mariner's Compass; the needle, from the peculiar mode in which it is suspended, being perfectly at liberty to dip in all latitudes, from the Equator to the Poles; while the card retains its *horizontal position*.

The first figure in the engraving represents the card, with the needle lying across it, in an orifice cut completely through the card from north to south. The card is perforated with a number of holes, to allow a free circulation of the air.

In the second figure, the compass is seen in perspective, supported on an agate center, and the needle *dipping*, while the card remains *horizontal*.

The advantages of this admirable invention are at once great and simple: in the first place, this compass increases its power of magnetic force where in others it diminishes, and that in every latitude from the Equator to the Poles; secondly, it retains its force even situated nearly over the Polar point, where all others entirely lose it, and become useless; thirdly, it is more steady on its point, a circumstance of the first importance, when the agitation is increased by the motion of the vessel.

A few remarks by way of elucidation will prove the above; the first property it gains from its peculiar construction, by which the magnet is placed more in harmony with nature; and among many particulars, the principal point consists in the needle falling in a line with the attractive effluvia; this is effected by uniting the nature of a dipping needle with that of a horizontal steering card; by virtue of which it has power to alter its own elevation, to every degree of latitude it may be placed in, and of course stands nearly in a line of attraction; this it performs without taking the card out of the horizontal position. The second it may be said to retain from the dip of the needle. for, at the poles, the dipping needle is found to increase its power, when that of the horizontal one is invariably lost. The third property it acquires by the manner of connecting the needle with the card; for when the motion is increased, and the compass exceedingly agitated, this needle quits the card, and attains a perpendicular motion which serves most effectually to counteract that of the card; so that between the motion of the card and the needle, the whole is brought to an equipoise; this in connection with the card of the compass being perforated, thereby admitting the air that is below the card, to pass freely above, without taking the card with it, renders it much steadier; and being placed deep in the box, it is not liable to strike against the glass like the common card.

It scarcely need be remarked that all compasses hitherto in use, diminish their power, every degree they are removed from the equinoctial line, which the inventor of the present patent presumes, is occasioned solely by an erroneous system in the manufacture of the needle, as follows, viz. the mechanic is first careful to make it equally heavy at both ends, so as to swing parallel with the horizon on its point or centre; this done, the needle is further completed by touching it on the magnet, for the purpose of gaining the magnetic poles; when it instantly acquires a different position, falling from the horizontal to an oblique direction: to prevent this, and bring it parallel again, he is reduced to the alternative of loading the south end, either of the magnet or the card; which effectually performs the intention of the mechanic, but

* Vide Vol. 1, page 392.

not of nature; for thus encumbered, the needle is eventually so impeded, that, when it is brought near the poles, its efforts are fruitless, the card falling all around without any direction, from the single circumstance of being lifted beyond its natural inclination: and the magnet also is hereby drawn by main force above the magnetic line, and is obliged in its own defence to hang either on the left or right of it, in order to form a greater angle; for it is the distance from the poles only that enables the horizontal needle to act at all; and hence, the variation may, apparently, be much increased hereby.

It may be suggested against this needle (from the fact that it is capable of being drawn nearly perpendicular when situated over the poles), that it will have no purchase or power over the card, and therefore cannot turn it round to its point: this would be correct but for the consideration of the poize of the needle, which always prevents a steering dipping needle from falling to its due depression or dip, leaving a sufficient power for the purpose of turning the card; this is also provided for by hanging the needle below its bearing.

The improvements in the New Compass are so evident, (as allowed by all the scientific who have examined it) not only for the high north and south latitudes, but for the East and West India services, as being less subject to get out of repair and lose the power of the attractive force, and also more proof against local attraction, &c. &c. This will appear more certain when it is recollected that all metallic substances (partly the cause of the variation) are contained nearer to the surface, than the centre, of the earth; they stand in the horizon, therefore the common mariner's needle being poised horizontally, the metallic lodgements (in the horizon) have power to attract a horizontal needle, when this new dipping steering needle points below that line, and forms nearly a true junction with the attractive influence, which is deep in the poles; hence this valuable instrument is not so subject to local attraction. Mr. Pope has adapted the principle of the azimuth to the steering compass, which is so constructed as to be capable of steering by, and of taking an azimuth of the sun; thus making use of one compass alone, both to steer by and to take the azimuth.

This compass is furnished with a temporary verge (or glass) to shift on when steering, which leaves the face of the azimuth as clear to see the points and steer by as the common steering compass, and with the same facility performs both operations. He recommends it, therefore, to general use, in preference to his steering compass; but, when the latter is used, one only should be in the binnacle to steer by, instead of two as is customary at present, for there must be local attraction where two compasses are so close together.

The reports of the Hudson's Bay Company on the subject of Pope's Dipping Needle Mariner's Compass, are quite as encouraging as that of Capt. Lyons in his late attempt to reach Repulse Bay.

In cases where the common compass becomes entirely useless, the able navigator is driven to the alternative of steering by the stars alone, which are not always to be seen, in consequence of thick weather, &c. For this reason, the addition of the dipping needle to the Mariner's Compass, is a matter of the first consequence to the instrument, and was never effected before the present time. From some experiments made by Mr. Pope, he is of opinion that the central part of the earth is one immense spherical magnet extending from the centre to 40 degrees, the remaining 50 being composed of strata surrounding that nucleus, and arranged from east to west. Now when the Mariner's Magnetic Needle, which is a subject of the principal one, the earth is brought up to latitudes above 60, the magnetic north being deep in the earth, the dipping needle in high latitudes is drawn almost perpendicular; and as it is now harnessed so as to be free of the card, and possesses both the advantages of the dip and of carrying the fly horizontally, its powers remain; whereas the old needle of the compass being rivetted to the fly, and the fly being loaded at the south end to make it poise, it is thereby forced against its natural inclination, and brought up to a horizontal position. It then turns its

back on its principal, the magnet of the earth, and herein, according to the inventor's opinion, consists the cause of the different effects of the old and the new compass.

We will not take upon ourselves to decide whether Mr. Pope's theory be correct or not; but leaving our readers to form their own opinion on this subject, we have no hesitation in expressing our conviction of the great importance and utility of the invention. The subjoined testimonials are selected from a very considerable number equally favourable, and we hope that the general adoption of the Improved Compass will amply reward the Inventor for his skill and ingenuity.

Letter from Dr. Birkbeck to Wm. Pope.

50, Broad-street, London, 6th May, 1824.

Sir—I had the pleasure of exhibiting and describing your very ingenious Patent Steering Compass, in a lecture on Terrestrial Magnetism, which I yesterday delivered in the theatre of the London Institution. Several gentlemen of considerable scientific eminence, who had not previously even heard of its existence, had thus an opportunity of becoming acquainted with its merits, and every one expressed a full conviction of its decided superiority. It is quite unnecessary to enlarge upon the advantages of your compass, because simple inspection is sufficient to establish them; but I may observe, that the idea of suspending the needle, so as to admit of the dip, is original, and calculated in all latitudes, much lower or much higher than our own, to add greatly to the promptness and freedom of its motion; and that your method of directing the card, by a light and moveable connexion with the needle, is at once effectual and ingenious. With such opinions of the value of your invention, you cannot doubt that your complete success in this undertaking would highly gratify,

Your's, &c. &c.
George Birkbeck.

Letter from Captain J. M. Arthur Law, R. N. to Wm. Pope.

London, 11th July, 1824.

Sir—The sluggishness or inefficacy of the ordinary steering compass, so dangerous and perplexing in high latitudes, must in a great measure proceed from the needle being attached to the card, aud so balanced by artificial means, as to preserve the horizontal position, instead of being allowed to take that downward inclination of the north pole, called the dip, which every bar of iron or steel acquires by the communication of magnetism. In the natural position of the magnetic needle, and in that alone, it may well be inferred, that the unknown cause of its polarity will act with the greatest power, or produce an undisturbed effect. In your Patent Compass so much is done to combine the dipping of the needle with the horizontality of the card, that I am convinced your invention needs only to become generally known in order to be duly appreciated. The perforation of the card, by which the extent of its surface is greatly reduced, and consequently its power of agitating the air contained in the compass-box considerably diminished, with another cause of free and prompt motion, perceptible in the light and moveable connexion between the needle, the card, and the cap, convey instantaneously to the mind, an idea of the advantages which an instrument of this construction must possess, in going far to obviate the effects of pitching and rolling motion at sea, and a very simple experiment on shore, may serve to show how much the extent and number of vibrations produced thereby in compasses of the common sort, will be diminished in those made according to your improved novel and ingenious plan. Such being the peculiar advantages of your Patent Compass, evident upon mere inspection,—and the testimonials you have from men of skill and experience, who have given it a trial in both hemispheres, being so satisfactory, whilst the increase of cost is so very insignificant,—I have no hesitation in strongly recommending you to spare neither labour nor expense in giving publicity to your invention; believing that by such means you will serve the public, and meet with such reward as may encourage and better enable you to proceed with those useful inventions which you have now in progress, and to pursue a course of experiments which may lead to important discoveries in that branch of science to which your attention has been so far successfully directed.—Yours, &c. &c.

J. M. A. Law."

" P. S. I observe now that something introductory to the subject of my letter may appear requisite. The fact is, that after the facilities you kindly afforded me of becoming perfectly acquainted with the nature of your important inventions, I felt it a duty to express my opinion of your Compass, that it might, if you thought fit, be added to more valuable testimonials."

Letter from Capt. J. Davison, to the Governor and Committee of the Right Hon. Hudson's Bay Company.

HONOURABLE SIRS—I beg to lay before you the result of the experiment and observations on Pope's Patent Dipping Needle Compass, which your Honours were pleased to send for a trial on board your ship. 'The Prince of Wales,' under my command, on our voyage the last season.

It affords me pleasure to state, that I found the Compass in question very superior to the common one, from its unusual steadiness in rough weather. It is hardly necessary for me to say, that with the motion of the vessel all Compasses become more or less agitated, and a difficulty arises to the mariner to keep the course. Pope's Compass keeps its points with greater accuracy than the common Compass. More improvements are produced, in my opinion, from Pope's Needle being allowed to dip instead of being fixed horizontally; and, also, from the circumstance of his card being perforated to admit a free passage of air underneath.

Another point of some importance I think it right to mention, which is, that the dip was increased in a higher latitude North.

On the whole I have no hesitation in saying, that his invention possesses considerable advantages, and will no doubt come to a general use. I would wish to add, that it would be desirable that two flys should be sent with every Compass: a heavy one for stormy weather, and a light one for fine.—I remain,

'Your Honours' obedient servant,

Jan. 12th, 1825. JOHN DAVISON.

LONDON MECHANICS' INSTITUTION.

MR. LEWTHWAITE'S THIRD LECTURE ON ELECTRICITY.

ELECTRIC SPARK—THE EFFECT ON THE THERMOMETER—IGNITION OF INFLAMMABLE BODIES—ELECTRIC LIGHT—LUMINOUS EXPERIMENTS, &c.

WEDNESDAY, 27TH APRIL.

Mr. LEWTHWAITE commenced his lecture this evening, by recapitulating the principal subjects illustrated in his previous discourses. He had clearly demonstrated the existence of *positive* and *negative* electricity, and had shewn that both these kinds of electricity may be produced by the same substance. He had also pointed out the consequences of classing metallic bodies as *electrics*, and had shown that electricity may be evolved by the contact of different metals, by the change of form occasioned by melting bodies, and by chemical action. Having thus explained the various methods of obtaining electricity, either with or without *friction*, he would now direct the attention of his hearers to the subject of the *electric spark*, and afterwards proceed to the consideration of *electric light*.

The *electric spark* always appears between the conductor of the machine and the body presented to it; but of its real nature we are in a great measure ignorant. In a periodical work recently discontinued, a passage or two had appeared, which the lecturer quoted on account of their connection with the subject which he was about to illustrate. The editor of the work alluded to had introduced a quotation from the Philosophical Journal, the writer of which observes, that electricity is never communicated, in any perceptible degree, to a distant or remote body, except through a current of air. In another quotation, from a different author, it is stated, that as it is well known that by the *compression of air*, a flash of light may be produced, it is supposed that electric light proceeds from the same cause, and is produced either by the *compression* or *ignition* of the air. Mr. LEWTHWAITE thought it unnecessary to repeat an experiment which he believed the members had already witnessed, by igniting a piece of fungus with a *compressing syringe*; but observed, that if the *electric spark* could be produced in a *vacuum*, the theory which supposes it to arise from the compression or ignition of the atmosphere, must necessarily fall to the ground.

The lecturer then produced a jar, which, in addition to the exterior knob, was furnished with two brass balls, situated at some distance from each other, in the interior of the vessel, the upper ball communicating with the exterior knob. Upon putting the machine in motion, and bringing this apparatus to the prime conductor, the spark passed between the two balls on the inside. Mr. Lewthwaite then exhausted the vessel, and upon again applying it to the machine, the spark passed from the upper to the lower ball as vividly and distinctly as before, though there was no air left in the apparatus. Now it is clear, from this experiment, that electricity passes visibly where there is no air; the electric spark, therefore, does not proceed from the condensation or ignition of air, and the electric fluid appears to be a substance or matter, independent of the atmosphere, though we are uncertain of its actual nature.

Mr. Lewthwaite here introduced several interesting experiments, for the purpose of conveying a better idea of the nature of the *electric spark*, by the effects it is capable of producing. That electricity acts like the matter of *heat*, may be inferred from its effect on the thermometer. The lecturer directed the spark against the ball of a thermometer, and stated that some caution was necessary in this experiment, as the spark must be passed gently on the ball, to prevent its breaking. The mercury soon rose from 69 degrees to 71, and would have risen much higher, by continuing the stream of electricity, which thus appeared to possess the common property of heat. Many bodies may be ignited by the electric spark, such as spirits of wine, ether, spirits of turpentine, phosphorus, &c ; all which substances the lecturer set fire to, in succession, by throwing upon them the electric spark from the conductor of the machine.

The power of the electric spark is not diminished by its passing through the human frame, for it would be seen that if the spark passed through the lecturer's body, upon presenting his knuckle to the surface of some ether, the fluid would be ignited. Mr. Lewthwaite observed that in order to exemplify this fact, he must *insulate* himself, by standing upon a stool with glass legs, by which means the passage of the electric fluid to the earth was prevented. This was accordingly done, and the lecturer, holding the conductor with his right hand, while the machine was turned, presented a knuckle of his left to a portion of ether, which instantly burst into a flame. The successful performance of this experiment elicited great applause from the audience.

To shew that the power of the electric fluid is not altered by its passing through *water*, Mr. Lewthwaite placed upon the lecture table four tumblers nearly filled with water, and connected with each other by pieces of copper wire, bent over the rims of the glasses in the form of staples, the points of which reached a little below the surface of the water. A small chain, communicating with the machine, was dipped into the water in the first glass, and some *ether* being poured upon the surface of the water in the fourth tumbler, the machine was turned, and the ether was instantly in a blaze, though the electric fluid which ignited it had necessarily passed through the water in all the four glasses. The lecturer conceived that the electric fluid was *condensed* during its passage through the water, but observed that there was no satisfactory evidence of the fact.

A small phial, filled with oil was then produced, through the cork of which a metallic wire passed into the phial. This wire was pointed, and bent at right angles, so that its extremity nearly touched the interior surface of the bottle, as it was moved round with the stopper. The spark was then passed through the wire, and striking against the inside of the phial, completely perforated it in several places. A small quantity of *fulminating silver* was then placed in a wooden mortar, and exploded by the electric spark with a loud report; and upon repeating the experiment in an ivory mortar, a small ball was forcibly projected to a considerable distance.

The explosion of *inflammable air* by the electric spark, was then illustrated by an experiment with a bladder filled with *hydrogen* and *oxygen*, in the proportions in which those gases unite to form *water*, viz., two volumes of hydrogen to one of oxygen. Upon passing the spark through this mixture, it was instantly inflamed, and the bladder burst with a tremendous report. This experiment may be varied in several ways, one of which affords a beautiful illustration of the formation of *water* by the union of *hydrogen* and *oxygen*. The lecturer exhibited this effect with a strong glass apparatus, the interior surface of which became covered with moisture after the spark had effected the union of the two gases; and he accounted for the explosion which accompanies their combination, by attributing it to the sudden rushing in of atmospheric air to fill the vacuum occasioned by the experiment. Another variation of the same experiment was then shewn, by placing upon the table an *electrical cannon*, charged with the mixed gases. The figure of a soldier was placed at a short distance from it; and the knob of a bent wire which he held in his hand was brought in contact with the cannon near the breech. A communication being formed between the conductor of the machine and the soldier, the cylinder was turned, and the cannon was immediately fired.

With respect to *electric light*, it must be acknowledged, that we are almost as ignorant of its real nature, as of the nature of the *electric spark*. It was supposed by the early electricians, that electric light was in-incapable of producing the prismatic colours; but Dr. Priestly has proved the contrary: and Dr. Brewster has ascertained that it is susceptible of polarization. Without entering minutely into theoretical speculations upon this subject, Mr. Lewthwaite observed, that he would leave the members to form their own opinion of the na-

ture of electric light from its effects, and proceed to the performance of a few brilliant and striking experiments, in which these effects were exemplified.

An elegant apparatus was then produced, consisting of a number of glass pillars, dotted spirally with tin-foil, and terminating in brass balls at the top. To the central pillar, a metallic cross was attached, with a knob at each of the extremities, and revolving on its centre. The lecture-room being darkened, the fluid was communicated from the machine to the apparatus, and the cross being put in motion, its extremities came nearly in contact with the brass balls belonging to the surrounding pillars, and as the electric light flashed through them in rapid succession, they assumed the appearance of columns of spiral flame, and produced a beautiful and brilliant effect. The spark was then passed through two glass tubes of considerable length, which became vividly illuminated in a similar manner. The lecturer then exhibited in succession a number of plates of glass, which had been previously coated with tin-foil, part of which had been removed from the surface of the glass so as to form a number of different words or figures. The electric spark was then communicated to these glass plates, and exhibited, during its rapid transit across the numerous notches cut in the tin-foil, the words "LIGHT," "FIRE," "ELECTRO-LIGHT," &c. in characters of vivid fire. A beautifully-luminous view of the Pagoda Bridge was also represented in the same manner, and Mr. Lewthwaite then observed that he should exhibit one more plate, which he had prepared expressly for this lecture: it was the genuine expression of his own sentiments; and if the members approved of it, he should be happy to present it to their museum. The electric spark was then passed through the plate, when the following sentence flashed upon the view of the audience:—

"SUCCESS TO THE
LONDON MECHANICS' INSTITUTION."

The kind wishes of the worthy lecturer, thus elegantly conveyed to the members, were received with the greatest applause; and Mr. Lewthwaite, whose numerous experiments had been performed throughout with uniform success, after intimating his opinion, from the experiment *in vacuo*, that electricity is a material substance, concluded by stating, that in his next lecture, he should treat of *accumulated electricity*, and introduce some experiments illustrative of the *Leyden jar*.

In our report of Mr. Lewthwaite's last Lecture, one or two errors inadvertently occurred, which our readers are requested to correct. At page 418, column 1, line 10 from the bottom, for "*glass*," read "*brass tube*;" and a few lines lower, it should have been stated that the friction of zinc upon silk produces "*positive*" instead of "*negative*" electricity.

Mr. M'WILLIAM, who presided during the evening, then gave notice, that preparations were in progress for establishing the DRAWING SCHOOL, and requested that those members who wished to become pupils would communicate their intentions to the Committee, specifying what branch of Drawing they were desirous of studying.

MR. OGG'S SECOND LECTURE ON HEAT.

CONDUCTING POWER OF BODIES—ATMOSPHERICAL PRESSURE—PRODUCTION OF STEAM—ITS LATENT HEAT—ITS APPLICATION TO MACHINERY—DISTILLATION——RADIATION OF HEAT—FORMATION OF DEW—RADIATING POWERS OF DIFFERENT SURFACES, &c.

FRIDAY, 22ND APRIL.

Mr. OGG stated, on commencing the present lecture, that he should again request the attention of his hearers to the subject of HEAT, and in the first place should introduce a few additional remarks on the *conducting power* of bodies, which he trusted would not be without their advantages. Air is perhaps the worst of all conductors of heat, and to this circumstance we are in a great measure indebted for the warmth of our clothing. It is true that many of the substances of which our clothes are made, are themselves bad conductors, and those which feel the warmest are the worst. It is also the fact that those articles of clothing which are furnished with the longest nap or fur, offer the most effectual resistance to the escape of the heat within the body, and thus impart the sensation of warmth. But why does this sensation depend so much on the length of the fur, &c.? Simply because within the fibres of the nap, hair, feathers or fur, there is a quantity of *non-conducting air* involved, and therefore the longer the nap, the more effectually is the escape of the heat prevented. This may be further illustrated by the operation of *double-sash windows* which are intended to inclose a quantity of air between them, and are chiefly used for the purpose of confining heat within the rooms during the winter. They would, however, as effectually keep the heat out

in the summer, if it was not more desirable at that season, to promote a free circulation of the air by opening them.

In his previous lecture he had stated that water boils at 212° of Fahrenheit, under the usual pressure of the atmosphere; but the temperature at which water may be made to boil varies under different circumstances. When the pressure of the air is sufficient to raise the mercury in the barometer to 31 inches more heat is required to boil water than when that pressure is only able to raise it to 28 inches. It is the great pressure of the atmosphere, which at the level of the sea is equal to 15lbs. upon every square inch, that occasions water to require so much heat to boil it; and if this pressure be diminished, less heat is sufficient for that purpose, while on the contrary, water subjected to a greater degree of pressure cannot be made to boil till it acquires a much higher temperature, and it has even been said, that under sufficient pressure, water may absolutely be made *red-hot.* But it may be asked, how it can be proved that water boils with *less heat* under a *diminished pressure?* Any person may convince himself of the fact by taking some water up a considerable eminence, when he will find that, as he ascends, the water requires less and less heat to boil it. At the summit of Mont-Blanc, which is between 15,000 and 16,000 feet in height, water boils at 187° instead of 212°. An instrument has been constructed, which points out with such accuracy the degrees of heat requisite to boil water at different elevations, that by this circumstance alone, the height of any place may be correctly ascertained.

That water boils with less heat, in proportion to the diminution of the pressure of the atmosphere, may be clearly demonstrated by other means. Mr. Ogg here availed himself of the assistance of the air pump, and having gently poured into a glass vessel some water which had been boiled, but had ceased boiling for some time, he placed the vessel on the pump-plate; and the pressure of the atmosphere being diminished by gradually exhausting the receiver, the water began to boil again with considerable violence. This effect is occasioned by the greater tendency which water possesses, under less pressure, to become converted into *vapour.* The water having ceased to boil under the receiver, a further quantity of air was extracted, when its ebullition was resumed, and in this manner, observed the lecturer, water may be *boiled* till it is almost *cold.* We are not always sufficiently impressed with a sense of the goodness of Providence, evinced in the wise provisions by which the operations of nature are governed. Were it not for the pressure of the atmosphere, of which we think so little, water would be universally converted into vapour, and mankind deprived of its beneficial uses.

Mr. Ogg here excited considerable surprise among his auditors, by observing that water might be *boiled* by the application of *cold,* and made to *cease boiling* by the application of *heat.* He then applied the flame of a spirit lamp to a flask partly filled with water, and while it was being heated, he explained the nature of *ebullition* by stating that the portion of water at the bottom of the vessel being first converted into vapour, the new-formed vapour ascends to the surface, and is replaced by other portions of water, which, from the same cause, ascend in rapid succession, and communicate the motion that occurs during the process. The water in the flask being now boiled, the vessel was withdrawn from the flame, and after it had ceased to boil for some time, the lecturer plunged it into a vessel of *cold water,* when it instantly boiled again with rapidity. While in a violent state of ebullition, it was withdrawn from the *cold* water and plunged into *warm,* when the boiling as instantly ceased. Paradoxical as these effects might appear, it was evidently proved that under certain circumstances, the application of cold would cause water to boil, and that the contrary effect was produced by the application of heat. Mr. Ogg now elucidated the apparent paradox by observing, that when the water was boiled in the flask, the *air* which it contained was expelled, and its place supplied by *steam.* When plunged into cold water, the steam became suddenly condensed into a small drop of water, and a vacuum being thus formed, the atmospherical pressure of fifteen pounds on each square inch was removed, and upon the principle which he had already explained, the water again boiled. But when it was removed into the hot water, a portion of steam was again produced, and the pressure being thus restored, the water ceased to boil, because under that pressure, a higher temperature than it then possessed was necessary to produce ebullition. Thus it is found that water boils at a low temperature under the receiver of an air-pump; under the circumstances exhibited in the experiment; and also on ascending high mountains; because in all these cases, that pressure of the atmosphere which tends to keep the particles of the fluid together, is in a great measure withdrawn

While upon the subject of boiling water, Mr. Ogg supplied an omission in his account of the experiment performed by Sir Joseph Banks and Sir Charles Blagden, related at the close of his preceding lecture. He should have stated that the gentlemen were surprised that the water contained in the large vessel did not boil, though the temperature of the air was 52 deg. above the boiling point. One of them supposed that it was because the heat was applied to the external surface of the water, and with the fertility of scientific invention, he suggested that a little oil should be poured upon it. This was accordingly done, and as soon as the oil had spread itself over the surface, the water boiled violently over the sides of the vessel.

The lecturer now proceeded to make some remarks on the production of *steam*. Some of the members might be disposed to inquire, why water boiled in an open vessel becomes no hotter, however great may be the heat which is applied to it? Because the *sensible heat* of the fire must enter into the water and become latent, before it can acquire the very great expansion which is necessary to form *vapour*. Water, in the state of *vapour*, occupies about 1,800 times its former space, and as all bodies require more latent heat when *expanded*, and less when *contracted*, it is necessary that a vast quantity of sensible heat should become latent or insensible, to enable water to assume the form of vapour. To ascertain how much sensible or thermometrical heat enters into water, and becomes latent when it is converted into vapour, Dr. Black put some water into a vessel, and first calculated the quantity of heat required to make it boil. He then continued the same degree of heat till the whole was converted into vapour, the vapour being at the temperature of boiling water, and he found that the quantity of sensible heat which had entered into the water, and become latent, was sufficient to have raised it nearly 1000 degrees above the boiling temperature; so that the quantity of heat necessary to enable water to assume the form of vapour is not much less than 1000 dagrees. One of the most important characters of steam is, that this immense quantity of latent heat may be again converted into sensible heat, by merely bringing the steam in contact with a cold substance.

Mr. Ogg now illustrated a remarkable circumstance connected with the latent heat of steam. If the hand be held in the steam which issues from a tea-kettle, it will become scalded; but if steam be generated under a great degree of pressure, and this heated to a much higher temperature, it feels cold to the hand. Water was then heated in a small steam boiler, which was placed on the Lecture table, and as a portion of the steam was allowed to escape, and rushed violently into the atmosphere, the Lecturer held his hand in it without inconvenience, though it was heated to at least 225°. This might appear as paradoxical as the previous experiment, but it was easily explained. As water heated under great pressure expands into steam with greater violence than under ordinary circumstances, it requires a proportionably greater quantity of *latent heat*, and not having time to take it from the atmosphere, it takes it from itself, or combines with its own sensible *heat*, and thus feels cold to the hand.

Previous to an illustration of the effects of steam as applied to machinery, Mr. Ogg exhibited to the audience a rugged piece of iron, which had nothing remarkable in its appearance, but might appear interesting from the circumstances connected with it. Some time ago a tremendous explosion took place in a manufactory of glue at Camberwell, where the principle of a *digester*, similar to Papin's, was applied to the extraction of glue from *bones*. For this purpose, high-pressure steam was thrown into a strong vessel, that the intense heat of the steam might dissolve the particles in the bones required for the production of glue. It was thought necessary to construct a larger boiler, capable of supporting a higher degree of pressure; and when this boiler was fixed, the Proprietor of the manufactory and the Engineer were present to see it heated for the first time, and witness its effect. According to the account given to Mr. Ogg, the pressure applied to the boiler was not nearly equal to what it was supposed capable of supporting, but when the assistant was desired to turn a stop-cock, he found himself unable to effect it, and that moment an awful explosion took place. The effect was terrific, and the resistance overcome was immense. The piece of tough wrought iron exhibited by the lecturer, was part of the boiler, which from its magnitude must have weighed several tons; yet the sides were torn away from the bottom as completely as if it had been made of wood and separated by a saw. It carried away the floor and the roof above it, and after reaching half as high again as the lofty chimney of the steam engine, it fell upon another building, which it crushed and destroyed in its descent, and came like a mighty ruin to the ground.

It was not his intention upon this occasion to introduce a steam engine for the purpose of illustrating the effects of steam as a *moving power*, as the subject would be sufficiently understood from the small apparatus in his hand, which represented in miniatnre several different parts of a steam engine. All steam engines, however complicated or various in their structure, are furnished with a *boiler*, a *cylinder*, and a *moveable piston*. Let the lower part of the small glass tube, now exhibited, and containing a small quantity of water, represent the *boiler*, and the upper part of the tube the *cylinder*, to which a small *piston* is fitted. Mr. Ogg now boiled the water over the flame of a spirit lamp till the air was expelled from the tube through a small aperture in the piston, and its place supplied by steam. The aperture was then closed, and the water being again boiled, the steam immediately forced up the piston. By breathing upon the tube a portion of the steam was condensed, and the piston descended. Thus it was seen that the pressure of the *elastic* steam forced the piston to ascend, and that when the steam was condensed, the pressure of the *atmosphere* compelled it to fall. It is upon this general principle that the action of the steam engine depends; but one of the most important improvements introduced into this machine by the late Mr. WATT, was accomplished by making the steam act *above* the piston as well as *below* it. Another of his important experiments was to condense the steam in a separate vessel without cooling the cylinder, and the piston was thus made to move both *upwards* and *downwards*, independent of the pressure of the atmosphere.

The effects of heat in the process of *distillation* were now illustrated by a beautiful experiment with a glass apparatus representing a *still*. The apparatus being perfectly clean and dry, the lecturer coloured some *water* with the *tincture of litmus*, and added to the mixture a portion of *alcohol*, or *spirits of wine*. The coloured fluid thus prepared for the experiment was *uninflammable*, which the lecturer proved by its extinguishing a lighted paper. This mixture was poured into the *alembic*, and the heat of a spirit lamp applied to it; and while the process was going on, Mr. Ogg observed that the object of distillation is to separate the spirit of wine, which had been previously produced by fermentation, from the water with which it is mingled; heat being applied, the spirits of wine assume the form of vapour soonest, and consequently come over first. This process is generally conducted in a large vessel of copper, and the volatile vapour is made to descend through a *spiral tube*, called the *worm* of the still, which passes through cold water. The vapour during its progress through the worm, is condensed by the cold, and giving out its latent heat, it assumes a fluid form, and falls in drops from the lower extremity of the spiral tube. The distillation of the coloured fluid in the glass apparatus on the lecture table was now sufficiently advanced to exemplify the remarks of the lecturer; and the condensation of the vapours which the members had observed to take place in the interior of the vessel, had produced a quantity of *pure, colourless*, and *inflammable liquid*. The pure *alcohol* thus separated from the coloured mixture was instantly inflamed by applying a lighted paper to it, and the applause of the members evinced their satisfaction at this elegant mode of illustrating the process of *distillation*.

Another important property of heat is *radiation*. This subject the lecturer elucidated by an apparatus consisting of two large concave mirrors placed opposite to each other, at the distance of several feet. (The construction of this apparatus will be clearly understood by a reference to the figure at page 235 of our First Volume.) The members were aware that *light* was reflected from polished surfaces; but invisible rays of *heat* were also reflected; and as they had seen inflammable bodies set on fire by an apparatus of this kind, perhaps another experiment would more fully illustrate the *radiation of heat*. Mr. Ogg then placed a heated ball of iron in the focus of the first mirror, taking care at the same time that the ball was not *red-hot*, in order that no *light* might proceed from it. The invisible rays of heat from the ball, falling on the first mirror, were reflected in straight lines to the opposite mirror, to the focus of which they were again reflected. In this focus an *air-thermometer* was placed, and the heat concentrated by the mirrors, immediately expanded the air contained in the instrument, and caused a rapid depression of the fluid. To prove that this effect was not produced by the rays of heat which proceeded directly from the heated ball to the air-thermometer, a piece of thick plate glass was interposed between the ball and the reflector farthest from the thermometer, by which the depression of the fluid in the thermometer was prevented, and by which it was satisfactorily demonstrated that it was occasioned by the heat radiated from the ball, and reflected from the mirrors in the way already described.

The manner in which the heated ball becomes cool was then explained by the lecturer, who observed, that if the ball be suspended so as not to be in contact with a conducting body, half its heat passes off by radiation and the other half by another process; for the particles of air nearest the ball being heated, expand and ascend, and are succeeded by other particles which ascend in succession, and in that manner carry off half the heat. To illustrate this remark, Mr. Ogg applied the air-thermometer both *under* and *above* the ball. In the former case the instrument was only exposed to the action of the *radiated heat*, and the fluid descended but partially. In the latter, it descended very rapidly, from the joint influence of the *radiated heat*, and the heat of the *ascending air*.

The observations already made on the subject of *radiation*, naturally lead to a consideration of the phenomena of *Dew*. It was long believed that the deposition of dew was occasioned by the condensation of the moisture of the atmosphere, which by the coldness of the night air, was formed into drops on the surface of the plants. This opinion, from the scientific discoveries of Dr. Wells, has been since discovered to be erroneous. He has satisfactorily proved that the deposition of dew is occasioned by the *radiation of heat* from the plants, and that those vegetable bodies which possess the greatest power of radiation become coldest, and are covered with the greatest quantity of dew; because the air which comes into contact with them being very much cooled by that contact, becomes incapable of retaining so much moisture in solution, and therefore deposits the largest portion on the surfaces of the coldest bodies. Dew is formed most copiously in clear nights, and it is observed that a fleece of clouds has the effect of preventing the radiation of heat from the earth. Dr. Wells has candidly acknowledged, that in the pride of half-knowledge, he had ridiculed the practice adopted by gardeners, of covering their plants with *matting;* as he had supposed it impossible to prevent them, by such means, from cooling to the temperature of the surrounding atmosphere. Subsequent observations had, however, convinced him that the matting prevents the radiation of heat from the plants, and that the practice is therefore beneficial. Upon the same principle, moisture is deposited on cool places; as for example, on the windows of a church, when the air being much colder on the outside than within the building, the moisture of the interior atmosphere coming in contact with the cold surface of the windows, is condensed into drops. The same effect occurs when a bottle of cold water or wine is brought into a warm room.

Only one circumstance connected with the *radiation of heat* remains to be mentioned, which is, that a *black rough* surface promotes its radiation, while a *bright polished* surface resists it. Mr. Ogg exemplified this observation by filling with hot water a square canister, all the four sides of which presented different surfaces. One of the sides was highly polished; another was dull and tarnished; the third was covered with a coating of red sealing-wax varnish; and the fourth with a black varnish. All these surfaces possessed different powers of *radiating heat*, or permitting its escape. When the air-thermometer was presented to the *polished* side, but little effect was produced; but the fluid descended rapidly on approaching the *black* surface. The great difference in the radiating powers of the two surfaces was thus clearly demonstrated; and it was evident, upon the same principle, that a *bright metallic* tea-pot would retain heat the longest, and make the strongest tea. Sir Humphry Davy, in his lectures at the Royal Institution, never failed to recommend to the ladies to use silver tea-pots, from which the lecture containing these instructions came rather ludicrously to be called the *Tea-pot Lecture*. Mr. Ogg added, that ridicule would never prevent him from suggesting the adoption of any practice which he believed to be useful, and this principle was applicable to many purposes of real utility. If, for instance, it is required to heat a room by means of steam, the surfaces of the vessels which radiate heat should be *black* and *rough*, but the pipes through which the steam is conveyed should be *bright* and *polished*. The effects of different surfaces in the radiation of heat may be further illustrated by filling two canisters of equal size, the one *white* and the other *black*, with hot water, at the same temperature, when it will be found, after the lapse of a few minutes, that the water in the *white* canister is much warmer than that which is contained in the *black* one, in consequence of the surface of the latter having radiated the greatest quantity of heat.

Mr. Ogg concluded his highly-interesting Lecture by some forcible observations on the beneficial effects of heat in the grand economy of nature. He universally admitted that all bodies, yielding to the law of attraction, have a tendency to be bound up in impenetrable ice, and would thus be rendered incapable of supporting animal or vegetable life; but the Almighty has com-

missioned this powerful principle, *heat*, to penetrate every pore of matter, and counteract the deadly influence: thus the surface of the earth is left open to vegetation, the waters are left at liberty to obey the attraction of the sun and moon to purify, delight, and fertilize, and the air is left at liberty to waft from the torrid to the frigid zones and back again, shaking blessings from its wings wherever it flies.

LECTURES FOR THE ENSUING WEEK.

Wednesday, May 11, Mr. Lewthwaite's Fifth Lecture on Electricity.

Friday, May 13, Mr. Ogg's Fourth Lecture, on the chemical properties of Common Air.

MR. PARTINGTON'S ILLUSTRATIONS OF THE MARQUIS OF WORCESTER'S CENTURY OF INVENTIONS.

Having, at the close of our last volume, given a correct copy of the Marquis of Worcester's celebrated Century of Inventions, we proceed to lay before our readers some extracts from Mr. Partington's excellent work, as specimens of the able and satisfactory manner in which that gentleman has elucidated the obscure hints of the Marquis.

6. How, at a window, as far as eye can discover black from white, a man may hold discourse with his correspondent, without noise made or noise taken; being, according to occasion given and means afforded, *ex re natâ*, and no need of provision beforehand; though much better if foreseen, and means prepared for it, and a premeditated course taken by mutual consent of parties.

Note. The *telegraph*, though not generally used in Europe till the commencement of the French revolution, appears to have been well known to the ancients. Polybius describes a method of communication, which was invented by Cleoxenus, which answered both by day and night. Kircher and Scott likewise allude to its use; but the description given by the Marquis is evidently superior to any that had preceded him; and, indeed, must have nearly resembled that in use at the present period.

7. A way to do it by night as well as by day, though as dark as pitch is black.

Note. The allusion here to a telegraphic communication is likewise sufficiently evident; though it is obvious that, for night signals, it will become necessary to substitute rockets or reflecting lamps for the painted boards.

Among the signs for nightly information at a distance, those by fire are extremely common, and have been used by the Chinese, Persians, and other nations, in the remotest times. This species of communication is affirmed by Diodorus Siculus to have been practised by Medea in her conspiracy with Jason, which carries us back three thousand and seventy years; and although there must be some uncertainty on this question, Pliny, in his "History," lib. vii. cap. 56, says, it originated with Sinon. "Specularem significationem Trojano bello Sinon invenit." This was the signal upon which Sinon agreed to unlock the wooden horse in the siege of Troy, about 1184 years before Christ:

> "—— Flammas cum regia puppis
> Extulerat."
>
> *Virgil. Æn.* lib. ii. 256.

And, after the taking of Troy, Æschulus relates, that Agamemnon immediately apprized his queen, Clytemnestra, of that event by a similar method; which we suppose, must have been done either by men placed at certain distances with lighted torches, which they held up in succession, or by a considerable number of fires on the tops of hills, denoting the simple fact previously agreed on between the parties. See Onosander's Strategicus, cap. 25, where this practice is described.

The fire-signals of the Greeks and Romans are also slightly mentioned by Quintus Curtius, Livy, Cæsar, Herodotus, Homer, and Thucydides; likewise by Vegetius and Frontinus; but still more in detail by Polybius and Æneas Tacticus; the latter of whom was contemporary with Aristotle, and has left a valuable fragment on the duties of a general, (translated into Latin by Casaubon,) wherein are many curious remarks on the subject of secret correspondence. The Greek signals were much improved by Polybius, who, in his history, (lib. x. cap. 45, p. 296. tom. iii. Lips. 1790, edit. Joh. Schweighaeuser,) attributes the invention to Cleomenes and Democritus, or (more correctly) to Cleoxenus and Democlitus, in words thus rendered: "Postrema ratio, cujus auctores sunt Cleoxenus et Democlitus, sed quam nos correximus, certa definitaque est, adeo ut quidquid exortum fuerit negotii, id possis certo facere notum." Prior to that period, the information communicated by torches, flags, smoke or otherwise, was very limited, and it was requisite to settle beforehand what each signal should mean; whereas Polybius showed how to corre-

spond alphabetically, and to give or receive any species of intelligence, without this previous concert. The plans of Æneas Tacticus had never arrived at such perfection, and were therefore of comparatively small use; though, without doubt, he at least equalled any of his predecessors in the facility of his telegraphic communications.

Combination Laws.

On Tuesday evening last, a conversation of a very important nature took place in the House of Commons, on the subject of the Combination Laws, in consequence of an inquiry made by Mr. Cartwright, on presenting a petition from the master boot and shoe-makers of Northampton. He asked the Right Honorable the President of the Board of Trade, whether it was in his contemplation to propose any further measure on this subject before the present session had expired?

Mr. Huskisson said, the hon. gentleman had asked him, whether it was intended to propose any measure this session, on a subject which he agreed with the hon. member deserved the serious attention of the house—he meant the present state of the country, with regard to the conduct of the workmen, whose practices, in forming combinations, were extending themselves to every part of the kingdom. The house were aware that a committee was sitting up stairs, for the purpose of investigating the effect produced by the law of last session. That committee was pursuing its labours with all proper vigilance, and would, he trusted, be in a situation to make a report to the house without the intervention of any great delay. He admitted, with the hon. member, that it was a subject which pressed for decision. It was not his wish, nor that of any gentleman on that committee, to interfere with the meetings, or combinations, as they were called, of those individuals, *so far as related to the amount of their own wages.* They were at liberty to take all proper means to secure that remuneration for their labour to which they conceived they were entitled—considering the circumstances of a greater demand for labour, or a greater expense incurred in the purchase of provisions. Under circumstances of this nature, they might reasonably ask for larger wages: *but they did not stop here.* They combined for purposes of the most unjustifiable description. They combined to dictate to their masters the mode in which they should conduct their business—they combined to dictate whether the master should take an apprentice or not—they combined for the purpose of preventing certain individuals from working—they combined to enforce the principle that wages should be paid alike to every man, whether he were a *good workman* or a *bad one,* and they levied heavy fines on those parties who refused to agree to their conditions. What he complained of, on the part of the employers, as well as on the part of those who were willing to labour, was, that the persons thus combined not only prevented the employers from carrying on their business with their assistance, but they prevented individuals who wished to work from getting employment at all. He believed that at the present moment a great part of the woollen manufacturers were standing still, on account of combinations of this sort. They existed in London, and he understood that they had spread through various parts of the country to a very extensive degree. He did not wish to resort to the old combination law. or to any measure that would not give equal protection to the *employed* as well as the *employer*. But unquestionably it was necessary that something should be done to remedy the existing evil. The tyranny of many would, he apprehended, be allowed to be worse than the tyranny of a few; and he must say, that the conduct of those who kept up those combinations threatened to destroy the peace and prosperity of the manufacturing interests. It was undoubtedly time to remove those evils; and he would, as soon as possible, endeavour to do so, by suggesting some efficient means for the equal protection of the *master* and the *workman.*

After some observations from Lord Althorpe,

Mr. E. Ellice said that a report would come down, in the course of a few days, from the committee who were investigating this subject, the suggestions contained in which would, no doubt, have their due weight with the house. Nothing could be more satisfactory than what had fallen from the right honourable gentleman (Mr. Huskisson), who had stated, that *no intention existed to re-enact the combination laws.* Much of the conduct of those people was, he allowed, perfectly unjustifiable. The house ought, however, to recollect the state from which they had been so suddenly relieved; and if the subject were fairly considered, it could not be doubted that the alteration had, in some instances, created great inconvenience, before a just idea of all the effects of the new system could be formed. He was happy to find

that it was not intended to call for the re-enactment of the combination laws; and he hoped that whatever measure might be proposed, the interests of the *workmen* would be well weighed and protected, and that they would not, as before, be exposed to the oppression of the *masters*.

General GASCOYNE, Mr. MABERLY, and other members, delivered their sentiments on the subject; and the General having mentioned a rumour, that it was the intention of the committee to interfere with "Benefit Societies," Sir M. W. RIDLEY stated, that no suggestion at all affecting Friendly Societies had been made in the committee.

Mr. HUME said, he believed what the house wanted was *impartial information* on this subject. They had as yet received tales from one party, and from one party only; and he would take upon himself to say, that so far as the committee had gone, every enquiry tended to do away with the impression which had been previously made on that house. No excesses had been committed, except in Dublin, and there, instead of twenty, only two lives were lost. He would leave Dublin out of the question, and he would say that the evidence before the committee proved that the character of combination amongst workmen was entirely changed. Instead of outrage and violence, peace and order appeared in their proceedings. He wished to see the workmen act properly, and therefore he condemned, in the strongest terms, their interference with apprentices, as being entirely contrary to the principle of freedom of action which they themselves demanded, and which they had gained. Much had been said about the combination of the men; but was a combination amongst them ever heard of, without there being also a combination among the masters? Would not any landholder in that house, who was selling his wheat for 45s. a quarter, endeavour, if he could, to procure 53s. for it? Nay, would he not keep his wheat back, if he thought he was thereby likely to get 90s. a quarter for it? Why, then, should not the man who only received 2s. 6d. a-day keep back, if he thought by so doing that he could procure 5s. 6d. a-day? Why should a different system be adopted with regard to these two parties? If a contrary doctrine were maintained, they might introduce laws to raise the price of corn, and to lower the rate of wages. On behalf of the workmen, he called on the house to come to no hasty decision on alleged acts of outrage and violence. If acts of violence had been committed, let them be stated before the committee, which hitherto had not been done. Let not those individuals, on mere assertion, be deprived of that birth-right which they now enjoyed, and which they ought to enjoy under the law.

Lord A. HAMILTON and Mr. BARING strongly deprecated the acts of violence which had been committed by the workmen, and their combinations for the purpose of preventing others from setting their own price upon their labour; after which, the petition was laid upon the table.

This conversation will have the effect of allaying the apprehension excited in the minds of the operatives, that it was the intention of the committee to recommend to the house the re-enactment of the COMBINATION LAWS. They will see that while they confine themselves to the legitimate object of obtaining a fair remuneration for their labour, they will have no cause for apprehension; and we trust that the remarks of Mr. HUME, the steady and enlightened advocate of the working classes, who condemns, in the strongest terms, their combinations for improper purposes, will produce a salutary effect upon their minds. We shall look for the report of the Committee with some anxiety, and shall endeavour to communicate the substance of it to our readers.

HUMAN TIME PIECE.

The following singular account appears in a recent number of a valuable French work, the "Bibliotéque Universelle."

J. D. Chevalley, a native of Switzerland, aged 67, has arrived at an astonishing degree of perfection in reckoning time by an *internal movement*. In his youth he was accustomed to pay great attention to the ringing of bells, and vibrations of pendulums, and by degrees he acquired the power of continuing a succession of intervals exactly equal to those which the vibrations or sounds produced. Being on board the steam-boat on the Lake of Geneva, on July 14, 1823, he engaged to indicate to the crowd about him the lapse of a quarter of an hour, or as many minutes and seconds as any one chose to name, and this during a conversation the most diversified with those standing by; and farther, to indicate by the voice the moment when the hand passed over the quarter minutes, or half minutes, or any other subdivision previously stipulated, during the whole course of the experiment. This he did without mistake, notwithstanding the exertions of those about him to distract his attention, and clapped his hand at

the conclusion of the time fixed. His own account of it is thus given: "I have acquired by imitation, labour, and patience, a movement which neither thoughts nor labour, nor any thing can stop. It is similar to that of a pendulum which at each motion of going and returning gives me the space of three seconds, so that twenty of them make a minute, and these I add to others continually."

MANUFACTURE OF INDIGO.

To the Editor of the Mechanics' Register.

SIR—If you think the following account of the making of indigo in the East Indies worthy a place in your valuable miscellany, I shall be glad of its insertion.

The plant from whence indigo is drawn grows in several parts of the East Indies. It somewhat resembles rosemary, and rises to the height of from 3 to 4 feet, bearing a flower like that of a thistle, and having a seed like fenegreek. When the plant is arrived at a certain height, and the leaves are in good condition, they are stripped from the stalks, and thrown into large pits half filled with water. Here they are bruised and stirred about till the water appears very thick and muddy, and after a few days settling, the water is drawn off, and the slimy sediment taken up in baskets, which are made into flat cakes, and afterwards dried in the sun. The people employed to sift the indigo, stop their nostrils, keep a cloth before their faces, with little holes for their eyes, and drink milk every half hour, to preserve them from the penetrating qualities of the dust, which, notwithstanding all their precaution, makes them spit blue for some time after. My informant tells me he placed an egg one morning near the sifters of indigo, and found the contents of it quite blue when he broke it in the evening.

This is the method of making indigo at Serquech, a large town near Amadabat, which is reckoned as good as any in the world: there is another method they have of making indigo, which I think is far preferable to the other. The leaves of this plant are thrown into a kind of vat, and covered with water, in which they are boiled for four-and-twenty hours, and a scum swims on the top with all the different colours of the rainbow. The water is then drained off into another vessel, where it is briskly stirred about till it becomes of a deep green, and till the grain (as they call it), forms itself. This they discover by taking a little of it out, and spitting in it, for if that occasions a bluish matter to subside, they leave off stirring the liquor; the matter then precipitates itself to the bottom of the vessel, and when it is well settled, they pour off the water. After this they take out the indigo and put it into linen bags to drain; which done, they put it into shallow wooden boxes; and when it begins to dry they cut it into slices and let them harden in the sun.

I remain your's sincerely,

JOHN H. BARRETT.

ROBERTS'S HOOD AND MOUTH PIECE.,

SIR—As the agent of Mr. J. ROBERTS for the sale of his HOOD AND MOUTH PIECE, I shall feel much obliged by your inserting in your excellent register the following reply to the well-meant suggestions of your correspondent J. S.

In the first place, sir, the use of valves did not escape the attention of either Mr. Roberts or some of his scientific friends who admired his ingenuity; but on consideration, it was determined that they would be not only useless, but injurious; as the manner in which the impure air is neutralized at the bottom of the funnel has all that effect, and two valves as recommended by J. S. would be dangerous, for if by any accident either valve was fixed, suffocation must ensue to the wearer; and so far from the respiration being at all laborious, as described, the alternate action of inspiration and expiration in the tube, is regular, pleasant, and easy, and the great acceleration of the pulse and *apparent* fatigue and lassitude at the two experiments arose from the heat only, which varied from 90 to upwards of 200 degrees, Fahrenheit, and it was so decided by the medical gentlemen who were present, as not the smallest extraordinary excitement had taken place in the lungs.

With respect to the shape of the tube, it is clear that your correspondent must be ignorant of the action of the apparatus, or he would be convinced that the funnel-shaped enlargement is absolutely necessary to its performance, as by that funnel the whole of the neutralization of the acids and impure air is carried on. I will not trespass further in reply, but merely to observe that considerable improvements have been already made in its manufacture, particularly as to its lightness, especially for the purposes of workmen in a dangerous atmosphere, the whole of which I should be very happy to shew your corre-

spondent, and explain the action of the apparatus, if he will favor me with a call.

I am, Sir, your's respectfully,
W. JONES.

8, Tysoe-street, Clerkenwell.

QUERIES.

No. I.—COLD CEMENT.

SIR—Having broken a small piece out of the top of one of the jars of an electrical battery, I should feel obliged if some of the intelligent readers of your valuable publication would inform me how to make a cement for uniting the same, without the application of heat.

I remain, Sir, your's respectfully,
ELECTRICUS.

No. 2.—FORMATION OF PEARLS.

SIR—Being an inquirer into the works of nature, I am induced to offer the following Query, in hopes that some of your numerous readers may favour me with an answer:—To what cause is the formation of pearls in oysters and muscles to be attributed? Your's, &c. W. H.

AEROSTATION.

SIR—Will you favour me by the insertion of the following Queries in your favourite publication?

No. 3.

What quantity of sulphuric acid and iron filings will suffice to fill with gas a balloon of a spherical form, ten feet in circumference?

No. 4.

Will tissue paper, varnished with linseed oil, answer the purpose of constructing this balloon?—if not, why?—and what will?

H. S.

No. 5.

What is the best method of polishing wood, with brass attached to it, without defacing the polish of the brass, or injuring its colour. I. J. D.

No. 6.

How to make a glaze, such as is used by the china makers in the manufacture of their ware?

No. 7.

To make the artificial stone, as manufactured by Croggon, and also the artificial marble? INQUISITUS.

ANSWERS TO QUERIES.

FULMINATING POWDER.

SIR—In reply to "FULMINATOR," (vol. 1, p. 383) I beg to state, that *Fulminating Mercury* will answer the purpose in *every respect*, of the description of percussion powder he wishes to meet with. It may be placed in the caps, with a strong tincture of *benzoin*, on the plan recommended by a writer in the Philosophical Magazine for September, 1823; but as caps are prepared with it by Messrs. Joyce, chemists, 11, Old Compton Street, Soho, it would, perhaps, be cheaper to procure them of Messrs. J. than be at the trouble of preparing them. A SPORTSMAN.

Vol. 1, Number 10, p. 158.

Query 1. Force the cork in.
2. A daughter.

Vol. 1, Number 13, p. 207.

Query 1.	3 pigeons at 4d. each -		0
	2 sparrows at ¼d - -		0½
	15 larks at ½d. - - -		7½
	20	1	8

2. Wait till it flies away.
3. *Neither*; there being two of equal length.
4. When he has not paid for his wig.
5. The letter M. I. J. D.

PATENTS EXPIRING NEXT WEEK.

Thomas Jones, for a new instrument for dividing lines and distances, which will be useful to mathematicians, architects, and draftsmen. Expires May 9, 1825.

Griffin Hawkins, for an apparatus calculated for the better defence of ships and vessels of different descriptions, against being boarded or taken possession of by an enemy. Expires May 9.

TO CORRESPONDENTS.

We have some doubts of the propriety of inserting the communication of HENRICUS.

Eff Ess on the smoke of oil lamps in our next.

The queries of Eff Ess, Philo-Domesticus, G. T. P. &c. will also appear in our next.

We beg to inform Mr. THOMAS that the address of Mr. DOWNES, the Secretary to the Spitalfields Mechanics' Institution, is No. 30, Earl Street, Finsbury Square.

We feel obliged to A MECHANIC, for his friendly communication, and shall not lose sight of the subject, which has also been suggested for our consideration from other correspondents; but at present considerable difficulties oppose the accomplishment of his object.

LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communications *(post-paid)* requested to be addressed.
Sold by SHERWOOD, JONES, & Co., Paternoster Row; and may be had of all Booksellers and Newsmen.
Also, Sold by A. & W. GALIGNANI, No. 18, Rue Vivienne, Paris; C. WILEY, New-York; CARFRAE, Rio Janiero.

THE LONDON
MECHANICS' REGISTER.

"A fool squanders away, without credit or advantage to himself, more than a man of sense spends with
"both. The latter employs his money as he does his time, and never spends a shilling of the one,
"nor a minute of the other, but in something that is either useful or rationally pleasing to himself
"or others." LORD CHESTERFIELD.

No. 30.] SATURDAY, MAY 14, 1825. [Price 3d.

WEBB'S AIR PUMP.

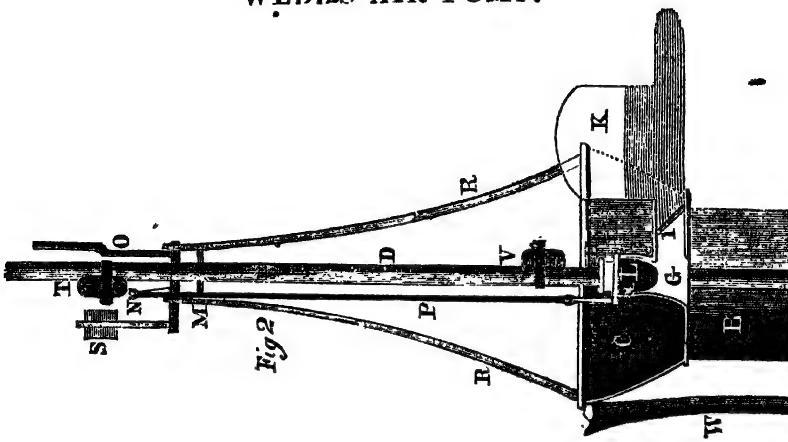


Fig 2

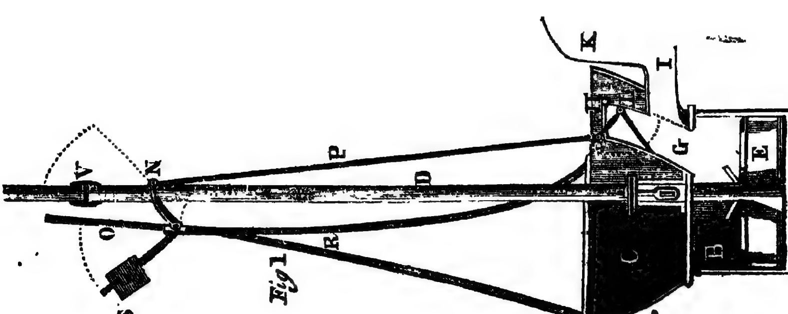


Fig 1

A

AIR PUMP, WITH A HOT WATER FEEDING BRANCH.

To the Editor of the Mechanics' Register.

SIR—This is a contrivance for making the air-pump of a steam-engine perform the office of the hot water pump, in addition to its other designed uses.

The air-pump I have copied from an engine designed by Mr. Murray, of Leeds, which had a basin, hot well, or cistern on the top for containing the hot water, which, I think, is preferable to those with a hot water cistern in front, as the hot water covers the socket of the pump top as well as the expelling valve, and prevents the admission of the air (a more subtle fluid) in the descent of the bucket.

Fig. 1. The top of the condenser A is shown, to give an idea of the situation of the air-pump. The same letters refer to both figures.

Fig. 2, is an elevation supposed to face centre of the engine; B, air-pump barrel; C, basin on the top; D, pump rod; E, bucket, G, expelling tube screwed to pump cover; H, expelling valve; I, a branch from expelling tube, communicating with the air vessel K, for supplying the boiler with hot water; L a valve in expelling tube, opening to the air-pump; M, axle; N lever; O, hand gear; P, rod for connecting the lever N with the lever attached to the valve L; RR, iron frame fixed to basin for supporting the valve M, &c.; S, a tumbling counter weight to rod P; T V, slides bolted to the pump rod diametrically opposite. When the bucket of the air-pump ascends, it brings up air, uncondensed steam, and the injection water. The air, steam, and part of the injection water is expelled through the valve H. When the slide V ascends, as seen in Fig. 1, it raises the hand gear O; the lever N, being fixed on the same valve, lifts the rod P, and shuts the valve L, the remainder of the hot water is forced through the branch I; into the air vessel K; a valve in the branch I, prevents the water returning. When the bucket descends, the slide T (Fig. 2) depresses the lever N, and opens the valve L again.

W (Fig. 2) is a pipe for conveying the surplus water from the basin C.

The dotted lines in Fig. 1, show where the hand gear, &c. was previous to its being moved by the slide V.

The slide V can be so adjusted on the rod that the supply of water to the boiler can be regulated to any quantity, which is not the case with hot water pumps, which are made of a larger bore than wanted, that the boiler may not be short of water, from any imperfections or wear in the pump. The quantity of water used varies with the density of the steam: should the boiler become short of water, the attendant on the engine can raise the hand gear O before the slide V strikes it, and increase the supply.

The beam in the steam-engine is said to rob it of part of its power, being "a heavy body alternately set in motion and brought to a state of rest." Many attempts have been made to make steam-engines without beams; but one of the difficulties attending them is the contrivance for the three pumps to act. A marine steam-engine, with some alteration, may be made with one pump on this principle; and I think this invention may be of some assistance in perfecting a more practicable rotatory motioned steam-engine.—Yours, respectfully,

J. WEBB, Engraver.

White Cottage (back of the Sportsman), City-road.

LONDON MECHANICS' INSTITUTION.

MR. LEWTHWAITE'S FOURTH LECTURE ON ELECTRICITY.

WEDNESDAY, 4TH MAY.

Mr. LEWTHWAITE, before proceeding to pares the strength of different materials, and is performed by suspending a number

the immediate subject of his present lecture, observed, that in one of his experiments on the preceding Wednesday evening, he had endeavoured to shew the effect of the electric spark on the thermometer; but as he had unfortunately mislaid the two wooden balls which he should have used in the experiment, the effect produced was not so great as he wished, and the thermometer was elevated only two or three degrees. He would therefore take the present opportunity of repeating the experiment, and avail himself of the striking electrometer; an instrument which was very useful when it was necessary to communicate the electric spark from one piece of apparatus to another. The two balls of ebony were then substituted for the brass ones, and the spark being directed against the bulb of the thermometer, the mercury, which then stood at 72°, rose in a short time to 84°; thus affording a striking demonstration that the heat of the electric spark on the thermometer, is similar to that of the matter of heat.

The lecturer now proceeded to elucidate the subject of *accumulated electricity*. In the experiments hitherto witnessed by the audience, the electrical effect was of a transitory nature, and continued only while the machine was kept in motion. The electric spark produced by the action of the machine, is sufficiently strong to shew a great variety of interesting experiments, and demonstrate the general principles of the science; but it was not till the method of accumulating considerable quantities of electricity was discovered, that the surprising effects since produced by the electric fluid were developed. This discovery was made by Mr. Muschenbrock, in the year 1746, and consisted of a vessel of glass, coated on the exterior and interior with tinfoil, or some other conducting substance.* It was called the Leyden jar from the name of the city where it was discovered. If a jar of this description be held near the prime conductor, while the machine is turned, a quantity of electricity is accumulated in it. If a conducting substance be now applied to the jar, so as to form a communication between the knob and the exterior coating, a spark passes, accompanied by a sharp sound; and if the conductor which forms the communication be a living body, an instantaneous shock is felt. When this method of communicating the electric shock was first discovered, the utmost astonishment was excited, and the most exaggerated accounts of its effects were promulgated to the world. Muschenbrock declared that it was two days before he recovered from the alarming effects of the shock, and that he would not undergo a second for the whole kingdom of France. Other electricians who tried the experiment, gave similar descriptions of its influence upon them, and these remarkable and ridiculous stories of the effect of the electric fluid having caused the greatest wonder among the common people, crowds of unlettered electricians flocked through Europe to display its powers to the multitude.

The more scientific practitioners of the science were however ignorant of the principle upon which the Leyden jar is charged, till Dr. Franklin's theory was made known, which supposes that one side of a charged jar is *negatively*, and the other *positively* electrified; and that charging a jar consists in taking the electricity from one side, and communicating it to the other. The form of the jar is not essential to its operation, for the same effect may be produced by a plate of glass, coated on both sides with tinfoil, provided one side is made to communicate with the earth. Some care is necessary in selecting the most proper kind of glass, for if it be very thin, it is liable to be perforated, and if very thick it will not hold a sufficient charge. To prove the superiority of thin glass over thick, the lecturer first took a thin plate of glass, coated with tinfoil as before described, and upon charging it from the machine, it appeared that it required three turns of the cylinder to produce a spontaneous discharge. He then substituted a thick plate of glass, which was spontaneously discharged by half a turn of the machine; thus proving that the thin plate was capable of being charged with about six times the intensity of the thick one.

The only use of the coating is to conduct the electric fluid to every part of the glass jar, and this may be made evident by using a jar furnished with moveable coatings. Mr. Lewthwaite produced a jar of this description, and after charging and discharging it in the usual manner, to shew that it produced the same effect as a jar with fixed coatings, he again charged it, and removed the coatings, and substituted another set of coatings; after which he applied the discharging rod, and the jar was instantly discharged. This experiment clearly proved that the electricity is in the glass, and not in the coatings. Persons who are desirous of constructing jars for their own use may employ common bottles; but as they cannot coat the inte-

* For a representation and description of the Leyden jar, vide vol. 1, pp. 401, 402.

rior with tinfoil, they may coat the exterior only, and introduce iron filings on the inside, by which means they may produce jars nearly as perfect as those generally used. A *naked jar* may be charged without using the coatings, though not so accurately as with them. If a piece of chain be suspended from the conductor of the machine, it will run about the interior of the jar, while the hand is passed over the exterior, and will become charged. Mr. Lewthwaite performed this experiment, and proved that the naked jar was charged, by inverting it over some pith balls, which were instantly in rapid motion.

In order to charge a jar it is necessary that the outside coating should communicate with the earth, or with some other conducting substance. To exemplify this remark, the lecturer suspended a jar to the conductor of the machine, and observed that if it was perfectly insulated in this situation, it would be impossible to charge it. The machine was then turned, and upon applying the discharging rod, only a very minute spark passed, which was occasioned by the proximity of the jar to the green baize on the lecture table; but when the hand was applied to the outside of the jar, so as to form a communication with the earth, the revolution of the cylinder charged it intensely, and a strong spark was drawn.

It would be recollected that in his first lecture he had laid it down as a principle, that all bodies possess their natural quantity of electricity, which is rendered sensible by friction, melting, chemical action, &c. Now when the jar is applied to the machine, it possesses its natural quantity of the electric fluid; but the electricity generated by the machine, disturbs its natural equilibrium, and the electricity of the outside passing round to the inside, the jar is said to be charged. Mr. Lewthwaite then shewed that a second jar might be charged by placing it in communication with the exterior coating of the first while the machine was turned. In this case the natural electricity contained by the outside of the first jar is given to the interior of the second, and the latter becomes charged at the expense of the former.

Some explanation may here be necessary of the terms quantity and intensity, so generally used in the science of electricity. If a jar be charged by a certain number of turns of the cylinder, and the action of the machine be uniform, a certain quantity of electricity will be thrown into it and the jar will retain that quantity of the electric fluid. The lecturer here charged a jar by twelve turns of the machine, and requested the audience to notice the length of the spark drawn from the jar, which was about an inch. The intensity of the charge is proportional to the length of the spark, and if two jars be charged together by the same number of turns, the spark will not be more than half an inch long, thus proving that though the same quantity of the fluid is generated, its intensity is diminished about one half, in consequence of the greater surface over which it is diffused. Mr. Lewthwaite proved this fact very satisfactorily by charging the two jars together in the manner described; but rendered it still more evident by repeating the experiment with the assistance of the quadrant electrometer, which measured the intensity of the charge very accurately; the index in the first case standing at 60° and in the second at 30 only.

Mr. Lewthwaite, by some other experiments, demonstrated that the outside of a Leyden jar may be charged as well as the inside, provided the interior is made to communicate with the earth; and also that a jar cannot be charged from the positive conductor of the machine if the chain which is suspended from the negative conductor, and communicates with the earth, be removed. Without this chain it would be impossible to perform a single electrical experiment with the machine, and it is evident from this fact that the earth is the grand repository of all our electricity.

The lecturer then observed, that a person might, with proper care, wipe out a jar or remove any substance that might accidentally fall into it, though the jar was highly charged with electricity. He would not, however, recommend his hearers to try the experiment. A very large jar was then placed upon the lecture table, and a powerful charge having been communicated to it, Mr. Lewthwaite took the indispensible precaution of insulating himself, by standing on a stool with glass legs, and he then took off the cap of the jar, wiped it out with a handkerchief and replaced the cap, after which he applied the discharging rod, when the length of the spark, and the loudness of the report sufficiently proved that the jar contained a charge capable of giving a severe shock, if the experiment had not been dexterously performed.

To elucidate still further the nature of charging a jar, and the disturbance of equilibrium which takes place during the operation, Mr. Lewthwaite supposed the whole quantity of electricity contained by a jar to be represented by 200. In its natural state the inside would contain 100, and the outside 100; but when the equilibrium is dis-

turbed by applying the jar to the machine, the exterior 100 is transferred to the interior, which then contains 200, or the whole electricity of the jar. A jar when charged contains no more electricity than it did before, being merely plus inside, and minus outside; and when discharged it still contains the same quantity; for the application of the discharging rod merely restores the equilibrium; the redundant quantity of electricity passing through the metal rod from the interior to the exterior of the jar.

Mr. Lewthwaite here introduced an ingenious apparatus called *the magic picture,* which depended upon the principle he had already explained, and charging plates of glass with electricity. The plate of glass exhibited by the lecturer was coated on both sides with tinfoil, but the upper coating was concealed by a picture representing a miser. A piece of money being placed upon the picture, Mr. Lewthwaite requested one of his hearers to take it up, which he attempted to do, but instantly received the charge instead of the money. Curiosity induced two or three others to try the experiment, and its ludicrous effect excited bursts of laughter among the spectators.

Several other experiments of a very interesting nature were then performed, one of which was called the *electrical pigeon-house.* Mr. Lewthwaite observed that he had endeavoured to illustrate this course of lectures by a number of experiments calculated to afford amusement to his hearers, without appearing to make a plaything of the science, and he hoped the present would not be deemed of too childish a nature. A small pigeon-house was then placed on the top of a jar, at some distance from which stood the figure of a sportsman with his fowling piece presented. When the jar was charged, several pith birds, attached by threads to the pigeon-house, became powerfully electrified, and fluttered about, till a discharge took place from the sportsman's piece, when they instantly fell as if shot.

The audience had already seen, by the effect produced on the thermometer, that *heat* was communicated by the electric fluid, and he should now endeavour to set fire to some powdered rosin, and also to another substance called lycopodium, by means of the electric fluid passing from the inside to the outside of a jar. Both these substances were then successively ignited, and Mr. Lewthwaite concluded by stating that in his next lecture he should resume the subject of *accumulated electricity,* and continue his experiments on jars and the battery.

At the conclusion of Mr. Lewthwaite's lecture, Dr. BIRKBECK addressed the meeting, and observed that he had availed himself of frequent opportunities of communicating to the members the favourable opinion entertained of the Institution, by the various benefactors who had contributed to its funds; and he had now the pleasure to state that he had received a letter from WILLIAM WILBERFORCE, Esq. inclosing a donation of TEN POUNDS. With the general benevolence of that gentleman's character the members were well acquainted; but the Committee conceived that the sentiments contained in the letter which conveyed the donation would be agreeable to their feelings, and had therefore requested him to read it.

Dr. Birkbeck then read the letter as follows:

"Uxbridge Common, April 12, 1825.

Sir—I must begin my letter by doing myself the justice to assure you, that my not having had the honour of being among the earliest of your supporters, arose only from my not hearing of the intended Institution till long after it had been formed. This arose from my having been compelled by two successive illnesses, to absent myself from London and its neighbourhood early in the spring of last year; ever since which period, I have been living in retirement in obedience to my medical advisers, with a view to the re-establishment of my health. I had understood that the just support which your excellent Institution had obtained was such as to render any further contributions needless. This consideration only prevented my sending in my little aid, which, not being needed for the object in view, might justly subject me to the imputation of vain-gloriously wishing to be deemed a supporter of a plan which had already been completely established. But I happened to hear the other day that in the further prosecution of the design, expenses will be incurred, for which further subscriptions are necessary. I therefore gladly transmit my little contribution, begging you to believe that it is a very inadequate measure of the esteem I entertain for the Institution itself, or of my wish that it may be productive of all the benefits which its warmest friends can venture to anticipate.

I cannot conclude without remarking that it adds to my satisfaction in relation to this business, that, if I mistake not, its chief projector is a countryman of mine—nay, I believe you are also a member of a

family whose friendly support I always felt myself honored by enjoying, during the whole period of my being member for the county of York.

I remain, dear Sir,
—for so allow me to style you,
With esteem and regard,
Your faithful servant,
W. WILBERFORCE.

Dr. BIRKBECK.

This letter was received with the greatest applause by the members, and the worthy President expressed the gratification he felt at the approbation bestowed on the Institution by this wise and good man. He trusted that the committee and the members would continue to deserve the patronage of such enlightened individuals, and that the Institution would never be unworthy of the applause of a WILBERFORCE.

MR. OGG'S LECTURE ON CHEMICAL ATTRACTION.

OPPOSITE EFFECTS OF HEAT AND ATTRACTION—ATTRACTION OF GRAVITATION, &c.—CHEMICAL ATTRACTION OR AFFINITY—ITS USES IN THE ARTS—DYEING, BLEACHING, &c.—EXPERIMENTS ILLUSTRATIVE OF SINGLE AND DOUBLE DECOMPOSITION—ACIDS AND ALKALIS.

FRIDAY, 6TH MAY.

Mr. OGG commenced by observing, that in the lecture of this evening he should endeavour to illustrate the effects of a force, the operation of which in the universe was directly opposed to that of HEAT. The force to which he alluded was ATTRACTION, and between these two great opposing forces an accurate balance of power is maintained, upon the preservation of which the whole frame of nature depends. If *heat* alone prevailed, its tendency would be to separate the particles of matter to a great distance from each other; while the predominance of *attraction* alone would bring them closer together; fluid substances would be solidified, and solid bodies would become still more dense.

Attraction is of several different kinds, and acts either at *sensible* or *insensible* distances; the former of which are susceptible of measurement, while no means exist of measuring the latter. To the first belongs the *attraction of gravitation*, and to the second the *attraction of aggregation*. It was not the lecturer's intention to dwell upon the attraction of gravitation or aggregation, as his present object was to illustrate the *attraction of composition*, or *chemical attraction*, and without entering minutely into the theoretical part of the subject, to recal to the recollection of the members, and imprint more strongly on their minds, those principles which, though previously explained in other courses of lectures, might have escaped their remembrance.

He had already stated that the *attraction of gravitation* is that which takes place at *sensible* distances. It appears that all the particles of matter are endued by the Creator with the power of *attracting* and the capability of *being attracted;* but of the real nature of gravitation we are ignorant, for the subtile principles which actuate nature are known only by their effects. It is gravitation which attaches bodies to the surface of the earth, and which, combined with other forces, regulates planetary motion. The kinds of attraction which act at *insensible* distances, are the attraction of *aggregation* or *cohesion*, and the attraction of *composition*, or *chemical affinity*. The attraction of aggregation is that which causes the particles of bodies of the *same kind* to unite; while chemical attraction brings into union the particles of bodies of *different kinds*.

The *attraction of cohesion* is usually illustrated by experiments which Mr. Ogg considered to be certainly defective. If two pieces of polished steel are placed together with a little oil between them, they cohere strongly; but in this case they are kept together by a different force, for the air being expelled from between them, the pressure of the atmosphere on their exterior surfaces unites them. Again, if the surfaces of two pieces of lead are scraped and placed together, they will adhere so powerfully as to support a considerable weight in addition to their own; but the truth is, that their rough surfaces are interlaced into each other, and they adhere chiefly upon that principle. The subject will be better illustrated by letting fall a few drops of *quicksilver* upon this plate of glass, where they assume the form of *globules*, and remain at a little distance from each other. Their spherical form is owing to their particles possessing a stronger attraction for each other, than for the glass or for the air by which they are surrounded; and if those globules are brought together, they immediately run into one. Upon the same principle, rain and the dew on plants are formed into small globules. The only perfect experiment illustrative of the attraction of aggregation is that of the engineer, by which he com-

of rods of different substances, and attaching weights to them till they break; the weight required to break each of them points out its relative force of aggregation.

The particles of bodies may be separated very minutely by *heat*, or by *chemical solution*. To illustrate the divisibility of matter by chemical solution, a glass was placed upon the table containing some water, to which the lecturer added a minute portion of *sulphate of iron*. This substance was composed of *oxide of iron* and *sulphuric acid*, and the quantity of iron it contained did not perhaps amount to the 20th part of a grain, yet in every drop of this water the presence of a portion of the iron might be detected. If we add to the mixture a little *prussiate of potash*, the *prussic acid* it contains will combine with the *iron*, and form *Prussian blue*. This was accordingly done, and the dense blue colour instantly assumed by the mixture indicated the presence of iron in every part of it. If the same quantity of the sulphate of iron had been mixed with a gallon of water, the addition of the test would still have rendered the presence of the twentieth part of a grain of iron sensible in every drop.

It need scarcely be mentioned how large a portion of the arts and manufactures of the country depends on the skilful management of the agency of *chemical attraction*. A few examples will indisputably establish this fact. In the process of *dyeing*, if the manufacturer wishes to communicate to a piece of cloth a colour for which it possesses no affinity, it is in vain that he dips it into a solution of that colour, for it will not adhere to it. What then is his resource? He endeavours to find some substance which has an affinity both for the colour and the cloth. He steeps the cloth in this substance, which is called a *mordant*, and after allowing it to dry, he again dips it into the colour, which then becomes permanently fixed. To facilitate the process of *bleaching*, the powerful agency of *chlorine* is employed; but in the process of bleaching with chlorine, a portion of water is decomposed, the hydrogen of which combines with chlorine, and muriatic acid is formed, which would attack the cloth and injure its strength. To obviate this difficulty, the manufacturer called to his aid chemical affinity, and by immersing the cloth in the bleaching fluid mixed with lime, the muriatic acid enters into combination with the lime; and the texture of the cloth is preserved uninjured. *Chemical attraction* is also resorted to in the conversion of iron into steel; the iron is heated in contact with charcoal, and by their mutual affinity, the carbon and the iron are united and the latter becomes steel. Chemical attraction is also applied to *engraving*; for the artist after covering his plate with wax, and tracing his design through it, pours nitrous acid upon it, which corrodes, etches or engraves the copper. Instances might easily be multiplied, but these examples were sufficient to illustrate the application of chemical attraction to the arts.

In order that the particles of bodies may be enabled to exert this attraction upon each other, they must be brought very near together by solution, pulverization, &c. When decomposition ensues in consequence of the exertion of chemical attraction, it is said to be simple or complex, single or double. Mr. Ogg exhibited an instance of single decomposition by filling a glass with solution of sulphate of copper, which is composed of sulphuric acid and copper, and is called blue vitriol in the arts. Upon plunging a spatula into the sulphate of copper, the iron having a greater affinity for the acid that dissolves the copper than the copper has, a portion of the acid is attracted by the iron, and the copper that is set free is deposited on its surface. Advantage was taken of this circumstance on a large scale at some of the copper works.

When chemical attraction is exerted between bodies, the compound which results usually possesses very different properties from either of its constituent parts. To exemplify this remark, Mr. Ogg prepared two *gases* in the following manner. He first mixed some muriatic of ammonia, with a portion of quick-lime and applied heat to it, by which means single decomposition was effected, and the muriatic acid of the muriate of ammonia having a greater affinity for the lime, entered into combination with it, and allowed the ammonia to escape in the form of gas. The other gas was prepared by pouring sulphuric acid upon muriatic of soda, or common salt, which is composed of muriatic acid and soda. The sulphuric acid combined with the soda, and the muriatic acid gas was set at liberty and collected in another vessel. The two gases thus obtained are both of a highly acrid and corrosive nature, yet when they become united by their powerful affinity for each other, they form a solid substance of a comparatively mild nature and without odour. The lecturer then brought the muriatic gas into contact with the ammoniacal gas, and the extraordinary changes which may be produced in the properties of bodies by chemical attraction were strikingly exemplified; as the two transparent gases, by their mutual affin-

ity, became converted into a dense solid substance, which coated the interior of the vessel. This substance is the muriate of ammonia, and it is produced by a similar process on a large scale for the purpose of commerce.

Mr. Ogg then illustrated the process of *double decomposition* by an experiment, in which he introduced glasses containing solutions of three different compounds, viz. sulphate of potassa, sulphate of soda, and sulphate of magnesia; to each of which he added a portion of muriate of barytes. Barytes having a powerful affinity for sulphuric acid, takes it away from all the other substances, and produces a dense white precipitate which is the sulphate of barytes. In all these cases, double decomposition ensues, the sulphuric acid exerting its strong attraction for barytes, while the muriatic acid of the muriate of barytes unites in the first example with the potassa, and leaves muriate of potassa in solution; in the second, with the soda, forming muriate of soda or common salt; and in the third with the magnesia, leaving muriate of magnesia in solution.

In the next experiment, the compounds used were solutions of the sulphate of magnesia and the carbonate of potassa, both of which were transparent. Upon mixing these compounds together, a new arrangement of their constituent parts took place, and the resulting compounds were carbonate of magnesia and sulphate of potassa. In this instance, the transference of the different substances was peculiarly evident, because the carbonate of magnesia was an insolubla compound, and was precipitated in the form of a white powder, while the sulphate of potassa remained in solution. The carbonate of magnesia is the substance usually called magnesia in the shops, and calcined magnesia is the same substance heated till the carbonic acid is driven off.

Acids and alkalis possess an exceedingly strong attraction for each other, but before exemplifying their effects, the lecturer performed an introductory experiment by placing upon the table two glasses containing the bright blue liquid produced by infusing the leaves of red cabbage in water. To one of the portions of this blue vegetable infusion he added a little muriatic acid, which instantly changed it to a bright red; and into the other he poured liquid ammonia, when it immediately assumed a bright green colour. It is thus seen that the acid changes the vegetable blue to red, and the alkali to green; but he had already mentioned that acids and alkalies have a strong affinity for each other, and he would add that by their union, they completely neutralize each other's properties. It therefore follows, that if the two coloured fluids already produced be mingled together in proper proportions, the original blue colour will be restored; for as both the acid and the alkali will have lost their respective properties by combination, no acid will remain to produce the red colour, and no alkali to produce the green. Mr. Ogg then mingled definite portions of the red and green infusions, when their union reproduced the original bright blue colour. The infusion of red cabbage affords a very delicate test for detecting the presence of either acids or alkalis.

The next experiment exemplified in a very pleasing manner what may be termed the play of *chemical affinities*, by successive compositions and decompositions. The lecturer added to some water in a glass vessel, portions of *sulphate of iron* and *tincture of galls*, the chief ingredients used in the manufacture of ink. A dark compound was thus obtained, through which the light was incapable of passing; its dark colour being occasioned by the mixture of the acid in the tincture of galls with the iron. Some nitric acid was now added to it, which restored the transparency of the fluid, leaving it slightly tinged with green. In this case the nitric acid possessing a stronger attraction for the iron than is possessed by the acid of the galls, unites with the iron and destroys the opaque colour of the liquid. Mr. Ogg then added some carbonate of potash to the mixture, and a new combination being thus formed, the compound became again dark and opaque as at first.

To enliven the subject, the lecturer exploded a small quantity of fulminating silver, which is composed of oxide of silver and ammonia; the ammonia being a compound of hydrogen and nitrogen. The theory of the explosion produced by this experiment is as follows: a portion of the hydrogen of the ammonia unites with the oxygen of the oxide of silver to form watery vapour, which together with the nitrogen which is set free, gives a concussion to the air.

In almost all chemical investigations, substances called *tests* are used for the purpose of producing certain changes, and enabling the practical chemist to detect the presence of substances in solution, which cannot be discovered by any other means. To shew the instrumentality of such tests, Mr. Ogg exhibited a piece of paper of a *bluish* colour, which had been produced by steeping it in tincture of litmus. If this paper, is plunged into any liquid containing an acid, its colour is immediately changed

to *red*; and if after being reddened, it is plunged into an alkali, its original *blue* colour is restored. The lecturer exemplified these effects, and observed that paper stained with turmeric affords similar indications, though in a different manner, its *yellow* colour being changed to red by an alkaline infusion, and restored by plunging it into an acid.

The strong affinity of carbonic acid for lime was most distinctly exhibited, by means of the clear transparent fluid, lime-water. The oxygen of the atmosphere being converted into carbonic acid by the process of respiration, it is only necessary to breathe through lime water to form a white precipitate by the combination of the two substances. Mr. Ogg breathed through the clear liquid before him, when the formation of carbonate of lime was rendered evident by its immediately becoming turbid and opaque.

Mr. Ogg's concluding experiment was an exhibition of the extraordinary effect produced by the contact of potassium with water. A piece of potassium was thrown upon the surface of a blue vegetable infusion, when it instantly burst into a flame, and the first effect which the lecturer pointed out was the change of the blue colour to green. This effect sufficiently illustrated the production of the alkaline substance potash, by the combination of the potassium with the oxygen of the water; and as the oxygen undergoes a change during this combination, upon the principles explained in his previous lectures, a sufficient quantity of latent heat is given out to inflame the hydrogen of the water.

The lecturer concluded by observing that the extraordinary properties of matter exhibited during the evening, were calculated to elevate our ideas, and excite our admiration of the wisdom and power of the Great Creator of the Universe. The next lecture would be devoted to an illustration of some of the most important chemical properties of atmospheric air.

LECTURES FOR NEXT WEEK.

Wednesday, May 18, Mr. LEWTHWAITE's sixth lecture on Electricity.

Friday, May 20, Mr. JOPLIN on Curvilinear Figures.

DURHAM MECHANICS' INSTITUTION.

In consequence of a report having been circulated by two or three individuals, that a few persons would meet on Monday, May 2nd, at Mr. Horner's, the sign of the Hat and Feather, Claypath, for the purpose of taking some steps with a view to the formation of a Mechanics' Institution in this city, upwards of 30 master tradesmen, and others interested in the object of the meeting, voluntarily assembled at the above place at the hour of eight in the evening.

On the motion of Mr. J. H. Veitch, seconded by Mr. Thos. Jackson, Mr. Mack was requested to take the chair, which he did accordingly.

Mr. J. A. Williams then rose and said, he much lamented that no gentleman of local consideration and talent had come forward to explain and enforce the objects and the benefits of such an institution as that which it was now proposed to establish. But the absence of gentlemen of the neighbourhood on this interesting occasion, was not to be attributed to any reluctance on their part to give their countenance and encouragement to the undertaking. On the contrary, he, (Mr. W.) knew that several gentlemen of the first character, and who were distinguished alike by their opulence and their ability, were anxious to promote and support such an institution by every means in their power. Their only objection to take a conspicuous part at the present moment was, that they were of opinion the persons for whose benefit the institution was chiefly intended, ought themselves to commence it. Rather, therefore, than that it should not be begun at all, he had himself ventured, humble as he was, to attempt to make a beginning. Mr. Brougham had truly said, in his excellent pamphlet on this subject, that "the only thing is to begin." Even if (which, however, he did not anticipate) the attempt should fail, no discredit could reflect upon those with whom it originated; and if it succeeded, it could not but be glorious to its promoters and beneficial to thousands. The great object was the instruction of all; the diffusion of useful knowledge. It was a mistake to suppose that the advantage of mechanics only was in view: the plan of these institutions embraced the whole of the operative classes; and no persons were more likely to be benefited by them than the farmers, for none required in their pursuits more scientific knowledge. All who needed information in every branch of useful industry had the opportunity of obtaining it by means of these institutions. He had heard some objections upon the plea of practicability of establishing such an institution in Durham. With him that objection had no force. The presence of so many persons, with so little notice, willing and desirous at the present meeting to support the attempt, was sufficient to refute that objection. He had no doubt of the practicability. Indeed, when it was known that a commencement had been made,

they might expect liberal donations in money, or books, or apparatus, from quarters of which they had now little thought. The first thing now then was for the present meeting to adopt the principle of a Mechanics' Institute. That might be done by a single and brief resolution. The next was to consider the means by which the plan could be best carried into effect. The most obvious course for that purpose would be to appoint a committee. One great rule which it would always be necessary to bear in mind, was that the institution should on no account be exclusive, and another suggestion he would throw out was, to make the subscription as low as possible. But these and many other matters might be easily settled in the committee. The adoption of the principle and the appointment of a committee, seemed to him to be the two material things to be done at this meeting. He would read from Mr. Brougham's pamphlet two or three passages describing the origin and progress of similar institutions in other places. [Mr. W. then read an account of the rise of the present institution in Glasgow, and of those in London, Newcastle, and Kendal.] The latter case seemed to be the one most analogous to Durham. He then referred to many great and illustrious men who had risen by the mere force of intellectual attainments from the lowest to the most exalted society. Among those he particularly instanced Franklin, whose name was familiar in every civilized nation; to Dr. Hutton, who from a pit-boy became astronomer royal; to Sir Richard Arkwright, originally a barber; to James Watt, whose name was inseparably identified with one of the grandest discoveries of ancient or modern times; to Sir Humphry Davy, once an apothecary's boy; to Professor Millington, a most ingenious and highly esteemed individual; to Dr. Birkbeck, the founder of all these institutions, and who he (Mr. W.) understood, had also raised himself from a comparatively low situation to honour and distinction; to Lords Eldon and Stowell (local instances), one the Lord Chancellor of England, the other also a judge, and the author of a code of maritime laws, &c. &c. Mechanics' Institutions were unknown in the early days of those exalted persons; but if they had been formed then, the number of persons eminent for their acquirements, and for the benefits conferred upon society by such examples, would, in all human probability, have been multiplied a thousand fold. It was the opportunity that was wanted for MIND to display its powers. He could not resist the temptation to quote Gray's beautiful lines, they were so applicable to the subject.

"Full many a gem of purest ray serene,
The dark unfathomed caves of ocean bear,
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air."

After a variety of other observations, Mr. W. concluded by thanking the meeting for the patience with which they had heard him, and observed, that if it were necessary to stimulate them to support the present undertaking, he would again refer to the many great and splendid examples of the utility and beneficence of knowledge—to some of which he had alluded—to those illustrious and mighty benefactors of their species, whose names had filled the world with their renown, and whose glory was not like that of warriors, and conquerors, and princes, and monarchs, but a glory that perisheth not, nor passeth away, and which would be coequal in duration to the world itself; and let it be hoped that there were in that very room some who would aspire to emulate those great and good men, and who would leave to their posterity names as venerated and dear as the names he had mentioned were to us. [Our limits prevent us giving more than a very brief outline of Mr. W.'s observations, which were warmly applauded.]

Mr. Stonehouse then proposed a resolution, to the effect that it was desirable to establish an Institution in Durham upon the principle of the London Mechanics' Institution. It was agreed to unanimously.

Mr. Williams proposed that a committee be appointed to carry into effect the objects of the meeting, which was also agreed to unanimously.

Mr. J. H. Veitch proposed that Mr. Mack, Mr. Addison, Mr. Geo. Walker, Mr. Strong, Mr. Geo. Robson, and Mr. T. Jackson, be named as a committee, with power to add to their numbers. This resolution was also agreed to unanimously.

Mr. W. J. Fewster was then requested to act as honorary Secretary, which office he accepted.

Thanks were then voted to the Chairman for his liberality in taking the chair and for his manner of conducting himself in it, and the meeting separated, after some other matters of course had been disposed of. It is only just to add, that a meeting more harmonious or apparently more ardent to promote the objects of it, was never held.—*Durham Chronicle.*

THE LIFE OF A SAILOR.

How *melancholy* is the life of a sailor! From the first hour of his embarkation, his habits and modes of life become essen-

tially different from those of his brethren on shore.

His habitation is not fixed, and seems to have no foundation—now leaning to this side, now to that; acted upon by every wave, and every breath of wind.

Even his food is unnatural; it engenders diseases, and can only be relishing from long habit.

Frequently he does not behold the cheerful face of WOMAN, green fields, or cottages, for months together; so sad are the watery deserts which he traverses, that a *solitary* and *sterile* land becomes to him an object of interest.

At night, he slumbers in a narrow hammock, from which, in the midst of dreams of home, he is often roused by the sound of danger: rushing on deck, he finds the vessel driven before the blast, or laid down upon her side by a sudden gale; the remainder of the night is spent amidst cold and wet, and darkness and storms.

Even the morning light is hardly welcome, since it serves only to discover a turbulent and boundless ocean, in which he may possibly ere long be overwhelmed, and leave no sad memorial to tell his fate.

Yet to some how *pleasant* is the life of a sailor! For ever roving about, he enjoys without care that variety which the epicurean so sedulously and often so vainly seeks, as alone capable of giving a zest to the pleasures of existence. The fruits, the productions, the manners of distant climates, become to him as familiar as those of his own country. He sees nature under every aspect, and the widely-varying races of mankind, the Chinese and the Negro, the Indian and the Malay, are brothers with whom he has often conversed. It is the duty and pride of a sailor to struggle with the tempest, which inures his mind and body to fatigue and danger; but storms do not always vex the surface of the deep, nor do clouds always darken the face of heaven; at intervals favourable breezes bear him smoothly along. He sees the sun rise from the eastern waves in all his glory, and disappear in the evening as in a sea of fire. He contemplates with pleasure the tropical clouds, the rich and splendid colours of which bid defiance to the art of the painter, and awaken to admiration even the rudest mind; he alone, with his level horizon, can contemplate in all its magnificence, the star-light canopy of heaven, or the moon reflected on every side from a thousand broken waves. Who, then, would not undergo a few hardships and privations, to arrive at the enjoyment of objects so sublime? How pleasant is the life of a sailor! S. HOLLANDS.

PHYSIOLOGICAL EXPERIMENTS OF M. MAJENDIE.

Many of our readers have, no doubt, noticed the philanthropic exertions of Mr. MARTIN, of Galway, to enforce the observance of his bill for the prevention of cruelty to animals; and they may also recollect the recital given by that gentleman in the House of Commons, on a recent occasion, of the manner in which a living dog had been dissected by Dr. MAJENDIE, for the illustration of one of the lectures which he delivered in this country. Great part of Mr. Martin's statement was subsequently contradicted by the friends of the doctor; but the following account (if correct) affords too strong a confirmation of Mr. Martin's narrative. Humanity recoils with horror from the contemplation of a scene so revolting. Surely such refined cruelty cannot be essential to the promotion of science!

"PARIS.—A medical friend took me, a few days ago, to hear a physiological lecture, on the subject of respiration, by the celebrated Professor Majendie. The room, which was almost filled with young medical students, is in the form of a small theatre, and may contain from one hundred and fifty to two hundred persons. The lecturer was on the stage, standing before a large table, at one extremity of which was a trough filled with water, at the other several vases, and a philosophical apparatus. Three or four students were standing near the professor, who were to assist him in his operations. After explaining to the audience the different opinions that had been entertained at various times on the power and means of breathing, he told them that almost every system hitherto followed was founded in error, and said that he would prove his assertion to be a fact. He then took off his coat, and tied an apron round his waist. A small spaniel was brought on the stage; he was sleek, delicate, and handsome; his appearance indicated that he had been a lady's favourite. Poor Fidel wagged his tail, and was placed on the table. The professor took out a pair of scissors, and cut off all the hair that surrounded the animal's neck; it was turned over, and placed upon its back; two of the young men holding its legs, and a third pressing its mouth, to prevent its cries. M. Majendie then began to separate, with a sharp instrument, the skin and exterior flesh of the neck from

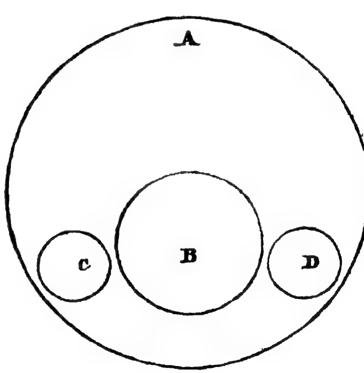
the windpipe, laying it quite bare. The stifled groans of the unfortunate spaniel were heard in every part of the room. This operation lasted ten minutes; at length, when every part of the neck was cut away, the arteries remained untouched, the poor animal was placed on his feet, and after running slowly about the stage for a minute, it lay down under the table, as if exhausted by its sufferings. The lecture was resumed, and continued during twenty-five minutes. Six or seven guinea-pigs were killed at this period, in trying the effects of various gases on the organs of respiration. He then explained the effect of gases on the blood; when in its pure and natural state, it is of a light colour, but coming in contact with atmospheric air it changes to a much darker appearance. To elucidate the fact, another experiment was to be tried on the spaniel. One of the assistants whistled, and with some difficulty the poor animal stood upon his legs, and came slowly towards its executioner. Forgetful of the cruelties it had endured, and pleased at being caressed (one of the students patting its back), it wagged its tail, and absolutely 'licked the hand just raised to shed its blood.' I am not more squeamish than other people, yet I declare this sight almost made me faint, and I still shudder at the horrid recollection. One of the arteries was then cut asunder, from which flowed a cupful of blood, and this was exhibited to the audience. The artery was immediately tied with thread, and the dog being placed on the ground, to my astonishment ran about the stage, although very weak, but apparently not suffering as much as I anticipated. The professor said the dog would not be able to eat or drink, but that he would live in this state three or four days. In about an hour he was again put upon the table, and a liquid preparation was syringed into the artery, which, after passing through different parts of the body, issued suddenly from the mouth, and coming in contact with the air occasioned a sort of explosion and blue flame. The sufferings of the spaniel were dreadful; every muscle appeared to be shaken; it writhed with agony. The professor expressed his surprise that the animal had not expired after such an operation; he attributed the circumstance to its state of exhaustion, although it was still able to crawl about the table. Another dog was now sent for, and a very large mastiff was led upon the stage. '*Non, non,*' was the general cry through the room; but the *no, no,* from the lips of the English medical students was peculiarly distinguishable. 'Eh bien!' said the professor, 'we will reserve the mastiff for the evening lecture.' The spaniel was again placed upon the table, the same operation with the syringe was performed, and, to my infinite relief the animal expired."

LOCO-MOTIVE STEAM-ENGINES.

To the Editor of the Mechanics' Register.

SIR,—The loco-motive steam-engine having become the subject of much public interest and discussion, allow me, through the medium of the REGISTER, to make the following remarks, which perhaps may lead to some improvement.

I believe it is universally admitted that the impelling power muwer must be of that description of steam-engine called high-pressure. The usual method of disposing of the steam in that kind of engine, after it has produced its effect in the cylinder, is to suffer it to escape into the open air or chimney; the latter is doubtless the better, the air in the chimney being rarified presents less resistance to the escape of the steam; in either case all the water and caloric combined therewith are lost. My proposition is to make the steam, as it escapes from the cylinders, pass through pipes placed near the bottom of the boiler, parallel with the flue in the horizontal, but not in the vertical direction. Let A represent a transverse section of the boiler; B the flue, or fire-place; C and D pipes



passing quite through, and fixed at an angle somewhat greater than that of any part of the road to be travelled, that the condensed steam or water should always run to the same end, a pump to be there placed to return it to the boiler. Suppose those pipes to be each six inches in diameter, and the pipes from the nozzles four, the latter should

enter the former, but not touch, a space of an inch all round being left that the air may freely mix with and condense the steam. The idea of converting the lower part of a boiler into a condenser, or refrigerator, can excite no surprise in those at all acquainted with the nature of heat. The difficulty with which it is propagated in water downwards, the inferior part of a boiler remaining at a low temperature long after the water above the flue has reached the boiling point, from this arrangement several advantages may be expected. Some portion of the caloric combined with the steam would pass through the pipes into the boiler, the current of air produced by the progressive motion of the machine would greatly facilitate the condensation, and afford, with perhaps a very small addition, the necessary supply of water for the boiler. Thus a rapid condensation going on would produce a partial vacuum, and greatly increase the velocity of the steam in its exit from the cylinders, which is equivalent to augmenting the elasticity of the steam at the time it enters it.

ONE.

ON ENGLISH GRAMMAR.

To the Editor of the Mechanics' Register.

SIR—If you should consider the following remarks in the least degree useful or interesting, you would oblige the writer by inserting them in your instructive REGISTER.

I have never, unfortunately, learnt one lesson of Grammar during the ten years of my scholastic education, which was entirely commercial. Consequently, as I have gradually emerged into the manners of life, I have deeply felt my ignorance of a grammatical knowledge of the English language. Lately I have applied myself diligently to acquire it, almost daily reading a portion of grammar, either from Murray, Lowth, or Hornsey; and it has ultimately occurred to me, that English grammar is by no means perfect (I do not at all allude to the new hypothesis of Mr. Fearn), from various contradictions that may be produced from different grammarians, and from the doubts they have occasioned by their several opinions. There are scarcely two of them who agree on many of the chief parts of grammar.

I will here mention two peculiarities, in order to induce your readers to look for others, and I can assure you they will derive great satisfaction from the search, for the study is not so *dry* as is generally believed.

1. By *cases of nouns* are meant their different terminations, which express their relations to each other; therefore, grammarians have, in such phrases as "*John's book,*" made *John* in the *possessive case*, on account of the addition of *'s* which is not *a different termination of a noun* (constituting a *case*), or any part of it, but an abbreviation of the word *his;* as they formerly wrote "*John his book,*" which was afterwards changed into "*Johnis book,*" till it at last assumed the present shape. The reason of these changes will be immediately evident on repeating the words of the first phrase. This proves that English nouns undergo no change whatever but what their genders require, and that other words are necessary to show their relation to one another, or their *case*, as the word *his* is a sign of the *possessive* or *genitive case*. How strange it is that we read in "*Mary's book,*" "*Mary his book.*"

2. Two negatives make an affirmative, but the use of them is improper. How often this impropriety occurs in the best writers may be imagined when we find it in such sentences as "*he is not unlike his father,*" "*she is not unworthy of it;*" the *an* invariably meaning the contrary of the word it is prefixed to; therefore, we might as well read, "*he is not like his father,*" &c.

A learned Bengalese has remarked in the preface to his English play, rather severely, "that he never met with half a dozen Englishmen who knew their own language correctly. True it is, that many never learn properly at school, and afterwards do not trouble their heads about it, on account of the complexity of the rules.

That we ought not only to learn English grammar before we study any other language, but also before we turn our attention to any art or science; that, with this knowledge, we could learn any thing else more easily, and in less time, than we could without it; and that it is actually indispensable for our converse with, and letters to, any person of respectability; are truths too apparent to need any thing more being said as a stimulus to the study of English grammar.

I have been induced to make these few remarks by a hope that they may induce some generous-minded persons, who may be connected with the LONDON MECHANICS' INSTITUTION, or any other society, which has for its object the education of the working classes, to consider of a more clear and correct mode of teaching this most useful acquirement, of which, I am persuaded, many stand in need; and that these observations, if neither amusing or

instructive, may at least, draw from some of your enlightened Correspondents, a more satisfactory explanation, is the sincere wish of S M. T.

QUALITY OF FOOD IN REFERENCE TO THE HABITS OF LIFE

The quality of food should have reference not only to age, but to habits. The richest aliment is by no means the best for every individual. In proportion as it affords chyle, it tends to repletion in those who take little exercise. If the merchant or artisan live freely on flesh, he suffers from feverishness, head-ache, or sluggishness. If the sedentary man of letters commit a like error, his mental, no less than his bodily, faculties are oppressed or disturbed. In these, and similar cases, the secretions are considerably reduced; less is thrown off by perspiration; less is poured into the alimentary canal. Consequently the blood, the great source of all the animal fluids, is expended in less quantity; and fewer materials for its regeneration are required by the system. The quantity of chyle should be reduced to a balance with the consumption effected by the secretions. If full meals be taken, vegetables should form a large proportion. On the other hand, the countryman who gains his livelihood "with the sweat of his brow," may safely charge his blood-vessels to the plenitude of health. No morbid plethora can take place, while the consumption equals the supply. His diet should be chiefly animal. On the same principle, the sportsman is hale and vigorous on a diet which would make the sedentary apoplectic. Captain Barclay, during his astonishing walk of 1000 miles in 1000 successive hours, took daily from 5 to 6lbs. of animal food. It should be remembered, that in civic life a state of full health cannot be maintained. It soon becomes the settlement of disease. Sometimes you see the citizen robust and florid as the peasant; but ere long you will find him labouring under an oppressive affection of the brain, or other serious disorder. The full health even of men trained for boxing, or running, soon declines. Horses, fed and trained for the course, lose their vigour after a certain time. The gamecock often dies, if he be prevented fighting at the period for which he is prepared. If the excess of vital power, produced by his diet, be not spent on an extraordinary effort, it becomes the pabulum of disease. It is also probable, that a diet excessively rich, though balanced by proportionate exertion, will, if long continued, considerably shorten the duration of life.—*Thackrah's Lectures on Digestion and Diet.*

HURTFUL INFLUENCE OF BAKERS' BREAD.

A correspondent of a medical publication says, "'A physician of extensive practice and long experience, has made the following remark: That out of fifty cases of indigestion and its consequent calamities, thirty-nine, on an average, may be cured by obliging the patient to use home-made bread, instead of that which is made by the baker. The writer of this article, also a medical man, can confirm, from his own experience as well as an extensive practice, the truth of the above remark, communicated to him by a brother physician. Bakers' bread is a perfectly *sui generis* substance, and is unlike any other bread. It always contains a portion of alum, and the subcarbonate of potash, and some other unknown ingredient. The proof of good bread is its keeping. Country bread will keep good a week, and this is a better test of the genuineness of bread than the usual test employed for alum. Bakers' bread binds the bowels, and produces nervous disorders, in many persons, of an alarming kind; and the writer well remembers the improved health enjoyed by the students of the college at which he was educated, after the medical professor had forbidden the use of bakers' bread, and an oven had been erected for the college baking."

QUERIES.

No. 8.

The best method of dissolving Indian rubber, and how to form it into different articles for use. INQUISITUS.

No. 9.—COLOUR OF CRABS & LOBSTERS.

SIR—Returning home after having heard Mr. Ogg's able lecture on Attraction, and ruminating on the many wonderful chemical changes I had just seen, I happened to pass a shop in which crabs and lobsters were exposed for sale. I began to consider seriously by what cause they were converted from a *jet black* to a beautiful *red*, and argued with myself whether their being immersed in water, and afterwards having heat applied, was the only cause of such a change, but not being able to bring myself to this way of thinking, I concluded in my own mind that some great chemical agency

must take place, and that by means of attraction. I have merely transmitted to you my own thoughts on the subject, in the hope that some of your numerous correspondents may explain the phenomenon, should you consider this letter worthy of a place in your esteemed publication.

I remain, your's with respect,

W. H.

No. 10.

Sir—I will thank some of your correspondents to inform me of the best form and materials for a small furnace to melt from one to three pounds of metal, in a room.

No. 11.

Also the hardest composition which can be obtained by a mixture of any of the following metals, which shall not require more heat for its fusion than tin does, viz. lead, tin, zinc, bismuth, or antimony.

Your's respectfully,

Philo-Domesticus.

No. 12.—smoke of oil lamps.

Sir—Being much annoyed by the smoke of an oil lamp, I was induced to try a bell glass and ball, which I presumed from the intensity of the heat proceeding from the flame and acting immediately upon the smoke, would effect its decomposition; but I find, from the profusion of smoke, and the weakness of the flame, at least 1-3rd escapes unconsumed, and consequently the ceiling presents as usual one entire sheet of black. Now to remedy this, I propose to substitute pipes or tubes for the chains by which the lamp is suspended, and by their communication from the top of the bell glass, with their ends directed beneath the lamp, so that the smoke may come in contact with the current of air passing upwards, it appears to me that this arrangement will cause the smoke to pass through the flame and be effectually destroyed. Should any of your Liverpool lamp readers feel disposed to improve upon this hint, I shall be happy to know the result of their experiments.

No. 13.

Sir—A tradesman has just commenced business, and to the surprise of all his customers, has only four weights with which he can weigh any number of pounds from one to forty. I should like to know the right weights, doubting not of their great utility to others as well as to your's, &c.

Eff Ess.

No. 14.

Sir—I shall feel obliged if any of your correspondents will inform me through the medium of the Mechanics' Register, how to japan stoves, &c. without injury by heat.

No. 15.

Also the best method of polishing flint-stones, marble, &c.

No. 16.

Also the best method of polishing engravings on stone, &c. after the manner of the ancients.

No 17.

Also the best method of preparing ox-gall for the use of teinters, artists, &c. in water colours.

Hammersmith. H. Mote.

No. 18.

Sir—If any of your numerous correspondents could inform me of the best means of keeping pencil drawings from rubbing out, I should be much obliged to them.

Blackfriars. G. T. P.

No. 19.

What is the best method of preserving flowers in order to retain their figure and colour? Tyro.

No. 20.

What will take out spots of wax (candle) from a black coat; and also, what is the composition of the principal mineral waters in England, &c. Mechanicus.

ANSWER TO QUERY.

ARITHMETICAL QUESTION.

Vol. 1, p. 108.

Tunbridge Wells.

Sir—If you have received no reply to the Schoolmaster's Bag of Nuts, as he wished to know what number each scholar had at the last division, I beg to submit the following statement; and should I have erred during the calculation, I hope your goodness will excuse the present intrusion.

A first obtained out of the bag 13440, the whole being 20160; B got 5040 of what A acquired, and C 4032; D procured 3744, being 6-7ths of the remainder of A's stock, and E got 624 of it. A scuffle then took place, in which B lost 2520, the half of his share, which D and E divided equally between themselves, making for each 1260. C's stock of 4032 was then attacked, when A got 1008, B 1344, D 1152, and C and E divided the remainder in equal shares, being for each 264. A and B were then beset, and A lost 756, and B 1008, being 3-4ths of what they last ob-

tained, which was divided as follows:—to A 441, B 882, C, D, and E, each, 147.

Now the master directs that D should give C 2101 from his present stock, and the 6720, or the 1-3rd originally left in the bag, should be distributed as follows:—to A 1-3rd, or 3360, C 672, being 1-5th of what remained, and the residue divided between B and E equally, which is 1344 to each.—And now to the grand Query of what number each scholar had at the conclusion, which is as follows:—

To A	4053
B	5082
C	3184
D	4202
E	3639

Making 20,160, original number in the bag.

Your's, &c.
EDWARD FRY LOAF.

HAMMERSMITH BRIDGE.

On Saturday last the hamlet of Hammersmith was in a state of the most lively bustle, in consequence of its being the day appointed for the grand ceremony of laying the foundation stone of the new Suspension Bridge, to be performed by his Royal Highness the Duke of Sussex, and to witness which the whole of the various orders of Freemasons were invited to attend. The fineness of the day caused great numbers of ladies and gentlemen to assemble at an early hour, and the inhabitants of the village, who had anticipated a crowded attendance, had prepared seats outside their houses for the accommodation of the public. Prior to the hour for the procession to move from the Hammersmith Coffee-house the windows of every house, and the various seats, presented an exhibition of the most splendid beauty and fashion. Several of the nobility and gentry, and a numerous body of Freemasons, assembled at the school house, Hammersmith, by three o'clock, and Sir Richard Birnie, together with Mr. Hanson, the Magistrate of the hamlet, had an organized body of Police Officers in attendance.

His Royal Highness the Duke of Sussex arrived between three and four o'clock, shortly after which the procession prepared to move towards the site of the intended bridge, where the foundation stone was to be laid. By this time every preparation was made which could give the ceremony a grand and imposing effect. Large festoons of laurel were hung across the principal streets, and bouquets of May flowers were every where to be seen, tastefully arranged, and flags, with the various insignia of Freemasonry, were conspicuously hung out, while the bells rang a merry peal.

The bridge is an undertaking of considerable magnitude and of great utility, and when finished will afford a long-wished-for communication between the counties of Middlesex and Surrey. On the arrival of the procession at the appointed spot, his Royal Highness was conducted by the stewards to lay the stone, when the architect delivered to him a trowel. Having placed the various coins of the present reign in the cavity, which was covered by a brass plate, bearing an inscription, stating the date, &c. when the stone was laid, His Royal Highness performed the ceremony with the usual masonic formalities, while cheers of the populace rent the air, and the band struck up "God save the King."

His Royal Highness, with a numerous body of gentlemen, then returned to the Hammersmith coffee-house, where they partook of a sumptuous dinner.

By the kindness of a correspondent, we shall shortly be enabled to lay before our readers a plan and description of this elegant bridge, which will not only be an important improvement, but a distinguished ornament to the river.

CORRESPONDENTS IN OUR NEXT.

LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communication (post-paid) are requested to be addressed.
Sold by SHERWOOD, JONES, & Co., Paternoster Row; and may be had of all Booksellers and Newsmen.
Also, Sold by A. and W. GALIGNANI, No. 18, Rue Vivienne, Paris; C. WILEY, New York; CARFRAE, Rio Janeiro, &c.

THE LONDON

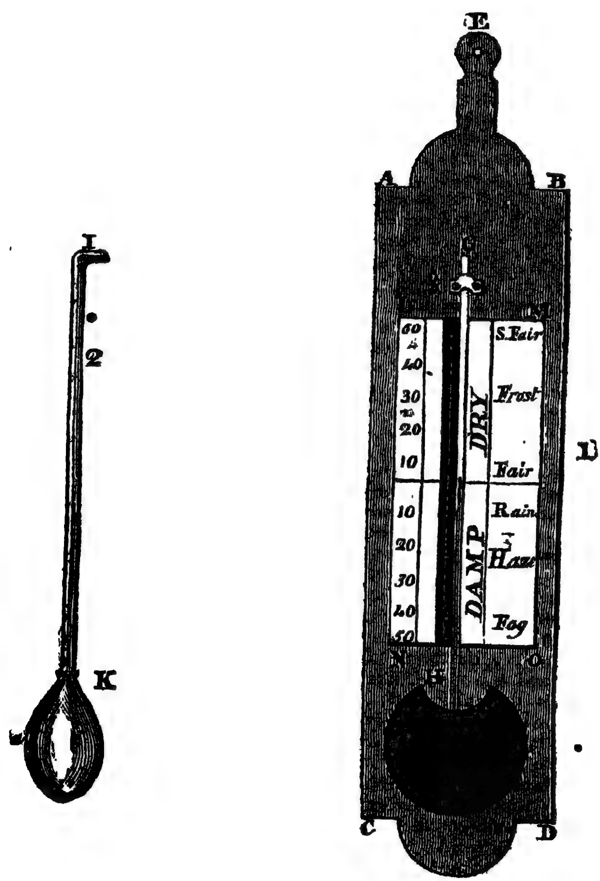
MECHANICS' REGISTER.

' It was not by vile loitering in ease,
" That Greece obtained the brighter palm of art;
' That soft, yet ardent Athens learn'd to please,
" To keen the wit, and to sublime the heart,
" In all supreme! complete in every part!
' It was not thence majestic Rome arose,
" And o'er the nations shook her conquering dart;
' For sluggard's brow the laurel never grows;
Renown is not the child of indolent repose."

THOMSON.

No. 31.] SATURDAY, MAY 21, 1825. [Price 3*d.*

WEEKES'S HYGROMETER.



WEEKES's HYGROMETER.

To the Editor of the Mechanics' Register.

Sir,—Having noticed that 'Medicus,' in No. 9 of your Register (p. 130), desires to be informed of a correct Hygrometer, the following which I have extracted from a periodical work, will be found to possess advantages over other and more complicated instruments; in being more simple, more delicate—in the result of action speedily obvious, in a manner immediately comprehended by the eye—in its portable structure, and I think in general application—Mr. Weekes is the inventor.

"A, B, C, D, fig. 1, represents a plain, smooth and polished piece of box-wood, about a foot in length, and half an inch in thickness, with a perforated brass plate, E, affixed behind, for the convenience of suspending the instrument; F is a hollow brass cup, for the reception of *a*, fig. 2; similar to those employed in common self-registering thermometers, and which secure the part *a* from external derangement. The atmospheric air must be permitted to have free access into this brass cup, at its upper part, around the lower extremity of the glass tube, G, H. I, K, fig. 2, a glass tube of small bore (equal to those used for the small mercurial thermometer) open at both extremities, and the upper end, I, bent about half an inch, at right angles with the long limb of the tube. The short part, I, fits into a hole at G, fig. 1, by which it is suspended, and its membranous appendage, *a*, is concealed by the brass cup before mentioned. *b*, fig. 1, is a small brass hold-fast, for the more perfect security of the tube, firmly screwed on to the box-wood frame. The scale L, M, N, O, requires but little description, it being simple, and its object obvious.

a, fig. 2, is the *air-bladder* of the common *roach* of our pools and rivers. One of those bladders should be chosen, which will contain from two or three drams of pure mercury, and leave sufficient space above it to admit the tube I, K. When the membrane has been sufficiently dried, by exposure to the atmosphere of an ordinary room for the space of three or four days, pour in the mercury, and insert the tube above it, so that it comes quite in contact with the surface of the metal, or even dips a little into it. Now, take a strong fine waxed twine, and contract the capacity of the bladder, by winding the twine strongly around the lower end of the tube, until the mercury rises midway therein. Fix the tube in its proper situation, and expose the instrument, in this unfinished state, to a dense fog, or to the densest atmosphere that occurs; or, what will succeed equally well, and save time waiting such an opportunity—fasten it by a cord, and suspend it in a damp well for the space of twelve hours. Either of these methods will have the effect of dilating the bladder to its greatest expansible capacity, and the mercury will have sunk very considerably in the tube. In an exact line with the surface of the metal, mark the verge of the scale N, O, which will represent *extreme damp*. Next let the instrument be placed in a secure position, within three or four feet of a moderate fire, until the mercury from attentive observation, is found to rise no higher; and observing the same mode as before, draw the line L, M, parallel to N, O, which will give the point of *extreme dry*. A third line drawn midway between the two, is the *zero* of the hygrometer. The scale on the left hand, may now be divided or subdivided at pleasure. Mine is graduated to 50 both *above* and *below* zero. The right hand side of the scale may be made to indicate the modifications of drought and dampness, as accurate and long continued observation may enable the meteorologist to decide. I have given *mere examples* in the accompanying sketch. If from long use or casual injury the fish membrane decreases in its capacity to contract or dilate (though this, I believe, will rarely if ever occur, excepting after a series of years, when it might be replaced by a new one), exposure, for a short time, to nitrous oxide gas will speedily restore it to its pristine susceptibility."

To give the scale such a basis as may establish a relation between all hygrometers that are constructed upon the same principle, Mr. Weekes, we see, has assumed two fixed points, *extreme humidity* and *extreme dryness*. I think the latter will be better determined in the following manner than by his process. Take a hot and well dried receiver, place under it quick lime, just calcined, it being of that temperature that it may be placed under the receiver without inconvenience. When the temperature of the inside of the receiver is

lowered to about 110 degrees, place the hygrometer under it. The choice of lime is founded on this, that the calcination of it having produced a higher degree of dryness, if it be afterwards left to cool, so far that it may be placed without inconvenience under the glass bell destined for the experiment, it will still be found as to sense, in the same state of dryness, since it is very slow in acquiring humidity; and thus all its absorbent power will be employed to dry up, by little and little, the air contained under the receiver, and to make the hygrometer itself pass into a state which approaches the nearest possible to extreme dryness.

It appears to me that this hygrometer cannot be quite correct, as heat will always expand the mercury in summer, and cold contract it in winter. Thus if it be supposed, for example, that the air is heated about the hygrometer,—this air, whose dissolving power with regard to the water will be augmented, will take away from the air bladder a portion of the water which it had imbibed, thus tending to contract it, while the heat by penetrating the quicksilver, will make it expand. And hence the total effect will be increased in hot weather, and decreased in cold. In observations which require, therefore, a certain precision, it is necessary to consult the thermometer at the same time with the hygrometer.

Rye. TYRO.

LONDON MECHANICS' INSTITUTION.

MR. LEWTHWAITE'S FIFTH LECTURE ON ELECTRICITY.

FURTHER EXPERIMENTS WITH THE LEYDEN JAR—IGNITION OF GUNPOWDER—VELOCITY OF THE ELECTRIC FLUID—ITS EFFECT ON THE HUMAN FRAME—CONSTRUCTION OF THE ELECTRICAL BATTERY—DESTRUCTION OF ANIMAL LIFE BY THE ELECTRIC SHOCK.

WEDNESDAY, MAY 11.

Mr. LEWTHWAITE introduced the lecture of the present evening by a brief recapitulation of the principal points illustrated in his previous discourse; in which he had shewn that the electric fluid is retained by the glass, and not by the coatings of the jar; that thin glass is preferable to thick in the performance of electrical experiments; and that a jar cannot be charged when insulated, or when the chain which communicates with the earth is detached from the negative conductor of the machine, the earth being the grand reservoir of electricity. Having concluded the last lecture by setting fire to resin and lycopodium, by attaching those substances to one of the knobs of the discharging rod, and passing the electric fluid through them from the jar, he would now endeavour to ignite the same substances, by directing the shock through some water. Two saucers were then placed upon the lecture table, which contained water, on the surface of which the lecturer sifted some *resin* and *lycopodium*. A communication having been formed between the saucers containing the water and the resin, the jar was strongly charged, and the shock being passed through the water, the resin immediately took fire. The same operation was repeated with the other saucer, and the lycopodium was inflamed in a similar manner.

The lecturer then placed a lighted candle between the knobs of the universal discharger, and having blown it out, he directed the shock of the charged jar through the apparatus, when the fluid, as it passed between the two knobs, instantly re-lighted the candle.

Having in a previous lecture shown that *alcohol*, or spirits of wine, may be ignited by means of the electric spark drawn from the machine, and being aware that many persons were not in possession of a machine sufficiently powerful to produce this effect by the spark, he would now shew that this substance may be ignited by means of the electricity accumulated in the jar, in the same manner as the resin, &c. Mr. Lewthwaite then covered one of the knobs of the discharging rod with *tow*, upon which he poured a quantity of *alcohol*, and upon applying the rod to the jar in the usual manner, the tow instantly burst into a flame.

The manner in which *fulminating mercury* was exploded in the next experiment was considered by the lecturer to possess some claims to originality. A small portion of this substance had been previously pasted between two pieces of card, about three quarters of an inch square, and upon passing the shock of the jar through it, the fulminating mercury exploded with tremendous violence.

Mr. LEWTHWAITE then observed, that

he was about to introduce an experiment which had nearly sunk into oblivion, when it was revived by himself about four or five years ago. He had, at that period, instituted a series of experiments on the *conducting power* of different fluids, for the purpose of ascertaining which of them afforded the most eligible medium through which the electric shock might be passed, in order to fire *gunpowder*. From the experiments which he then made, he found that gunpowder was fired more readily when the shock was passed through *alcohol*, than when *water* was the medium of communication; but as the latter fluid was always at hand, and was uniformly successful, he thought it unnecessary to introduce alcohol upon the present occasion. Mr. Lewthwaite then unscrewed the knobs from the universal discharger, and bringing the points nearly in contact with each other, he placed some loose gunpowder between them on the table of the discharger. A charged jar was placed at a little distance from the apparatus, and the communication between the interior and exterior was formed as before, by attaching one end of a chain to the outside of the jar, while the other end was hung upon one of the arms of the discharger; the inside of the jar being brought into communication with the opposite arm by means of the discharging rod. The object of the lecturer was to shew, in the first instance, that the gunpowder *could not be fired* by passing the electric shock through it, without the intervention of water, or some other fluid. The jar was then discharged, and the gunpowder was instantly scattered in every direction with considerable violence, but *was not inflamed*.

The jar was again charged and placed in the same situation as before, and the lecturer produced a glass tube about six inches long, filled with water and closely corked at each extremity. Through each of the corks a wire, furnished with a hook at the end, passed into the water. One of the hooks was then attached to the universal discharger, and the other to an arm of the discharging rod; and the jar being discharged, the electric fluid passed through the water, and the gunpowder was instantly inflamed. Mr. Lewthwaite repeated this experiment for the purpose of directing the attention of his hearers to the *smoke* of the gunpowder, which assumed the appearance of a ring, and undulated for some time in the atmosphere in that form. The circular appearance of the smoke in this experiment is similar to that which is produced by the explosion of phosphuretted hydrogen, when the gas rises from the surface of water. It may appear extraordinary that the electric fluid should inflame the gunpowder after passing through water, and fail in producing that effect when the water is not interposed; but it is considered that in the latter case the *mechanical action* of the electric fluid is so extremely rapid, that it has not time to inflame the gunpowder; and that when the water-tube is used, the passage of the fluid being impeded, it falls more slowly on the powder, and has time to ignite it.

As it has thus been seen that *loose gunpowder* may be so readily fired by means of electricity, it follows as a matter of course that gunpowder in a confined state may be fired with equal facility. To prove this fact, the lecturer produced a brass cannon, the touchhole of which was insulated with ivory. The cannon having been loaded with gunpowder, a brass wire was passed through the touch-hole, and being connected with the water-tube and the universal discharger, as in the last experiment, the shock was communicated, and the cannon was fired with a loud report, blowing the ivory touch-hole into the gallery of the lecture room.

In the historical sketch which he had given in his first lecture, of the rise and progress of electricity, he had mentioned an experiment performed by Dr. Watson and other gentlemen, who conveyed the shock through a distance of four miles, in order to ascertain the time which elapsed during the passage of the electric fluid from the interior to the exterior of the jar. To enable his hearers to form a better idea of the extreme velocity of electricity, the lecturer, during the afternoon, had caused a wire to be laid round the interior of the building, one end of which wire he should place in communication with the inside, and the other with the outside of the jar. In one part of this wire there was a break, at which was placed a small quantity of *fulminating silver*. He would now intensely charge the jar, and he requested the audience to pay particular attention to the time which elapsed between the report occasioned by the discharge of the jar, and that which resulted from the explosion of the fulminating silver; and if any perceptible period elapsed between the two reports, that period would be the time occupied by the fluid in its passage along the wire from the inside to the outside of the jar; a distance which had been measured by his assistant, Mr. Bluett, and found to be 90 feet. The jar was then discharged, and the fulminating silver was exploded; but the two reports appeared so perfectly simultaneous, that not the slightest difference was per-

ceptible either to the lecturer or his audience. This experiment was received with loud applause.

Mr. Lewthwaite again called the attention of the members to the *water-tube* used during the evening, and repeated his description of its construction. He then exhibited a second tube, corked at each end like the first, and similar to it in every respect, except that the two wires which passed through the corks, nearly touched each other in the centre of the tube. Mr. Lewthwaite then passed the charge of a powerful jar through it, when the glass tube was instantly shivered into a thousand pieces. This effect is accounted for by supposing that the electricity, in its short passage from one wire to the other, causes a sudden expansion of the water, which is sufficiently violent to break the glass.

As he was about to perform some experiments on the *animal economy*, he would in the first place shew that if the electric shock was passed through any part of the human frame, that part would be rendered luminous during its passage. Mr. Lewthwaite added, that as his son had volunteered the use of his thumb for the experiment, he would pass a strong shock through it from a battery jar, when the members would see the effect produced which he had described. The lecture room was then darkened, and Mr. Lewthwaite, jun. who has very kindly afforded his assistance during the present course of lectures, submitted to an operation, certainly of no very desirable kind, for the gratification of the spectators. The shock was twice passed through his thumb, which was rendered completely luminous, and was distinctly visible in every part of the room.

Having thus performed a variety of experiments by means of the single jar, he would now explain the construction of the electric battery, which consisted merely of any number of jars, according to the taste or fancy of the person who fitted it up. The battery which he was about to use consisted of five of these jars. In using the battery, it is necessary that the outsides of all the jars should communicate with each other; and if the jars are packed in a box, the best mode of forming this communication is to cover the bottom with tinfoil, or some other conducting substance. In the present case, however, the five jars were detached, and the connection was therefore formed by passing a chain round them. The inside coatings of the jars must also be made to communicate, which is effected by means of brass wires, placed horizontally between the knobs of all the jars.

From the very extensive surfaces which are thus formed by the construction of the electrical battery, the power of the apparatus is proportionably increased, and as he had already shewn the luminous effect produced on the human body by the shock of a single jar, he would now shew that the power of the battery on the lecture table was sufficient to deprive animals of life. The battery was then charged, and a living eel being taken from a glass jar which contained three or four of those animals, a hook was passed through its mouth and another through its tail. The communication was formed by connecting one of the hooks with the exterior surface of the battery, and the other with the discharging rod, and the battery being then discharged, the electric fluid passed through the body of the eel, and struck it dead in an instant. The battery was again charged, and the shock was passed through the body of a frog, which was instantly killed in the same manner.

Mr. Lewthwaite then observed, that as he had now exemplified the power of the battery by killing an eel and a frog, he would prove, if the members wished for further evidence of the destructive effect of the electric fluid, that the battery before him was capable of killing a larger animal, and he had a guinea-pig in readiness for that purpose.

The audience were, however, perfectly satisfied with the experiments they had already witnessed, and a general exclamation of "*no, no,*" saved the life of the devoted guinea-pig. Mr. Lewthwaite therefore concluded by announcing that in his next lecture he should again treat of *accumulated electricity*, which he should further illustrate by a variety of experiments, particularly relating to its effect on the *metals;* and on the following Wednesday, he should direct their attention to *atmospherical electricity*.

MR. OGG'S LECTURE ON THE CHEMICAL PROPERTIES OF COMMON AIR.

CONSTITUENTS OF COMMON AIR—NITROGEN AND OXYGEN—POWERFUL EFFECTS OF OXYGEN AS A SUPPORTER OF COMBUSTION—IRON BURNT IN OXYGEN—THEORY OF RESPIRATION—COMBINATIONS OF OXYGEN WITH OTHER BODIES—LEAD, PHOSPHORUS, CARBON, SULPHUR, &c.—CONCLUSION.

FRIDAY, 13TH MAY.

Having in his last lecture, illustrated the powerful attraction which the particles of

different bodies possess for each other, Mr. Ogg introduced the present discourse by stating, that it seems to have been proved that the attraction by which dissimilar substances unite to form compounds, depends upon their different states of *electricity*. The experiments of this evening would still further illustrate the force of attraction, and also some other important properties of matter. In proceeding to lay before the members an explanation of some of the most important properties of *atmospheric air*, he was aware that the same subject had been previously explained to them, and that his remarks might not possess much novelty; but though the same things might have been submitted to them before, it was impossible that by only hearing them once or twice, the important facts connected with the subject could be sufficiently impressed upon their remembrance. It was not his intention, upon the present occasion, to dwell long upon one of the constituents of common air, viz. *nitrogen*, as his attention would be principally directed to an illustration of the properties of *oxygen*.

Common air is composed of about four parts *nitrogen* and one part *oxygen;* or to speak more accurately, every 100 parts of common air contain 22 of oxygen to 78 of nitrogen. The *oxygen* of the atmosphere was first discovered by that eminent philosopher, Dr. Priestley, in the year 1774. In his original communication of this important discovery to the Royal Society, he was unable to find words sufficiently expressive of his admiration of its properties, and in fact they are such as fully to justify the admiration he felt.

Oxygen gas is ascertained to be a little heavier than common air. It is transparent and colourless. It is supposed to consist of an unknown base, combined with *caloric*, and this base is found in a variety of combinations with other substances in the solid form. It is a powerful *supporter of combustion*, in which combustible bodies burn with much greater brilliancy and rapidity than in atmospheric air. The glass vessels on the lecture table are filled with oxygen, and if a lighted taper be plunged into one of them, this effect will be immediately exemplified. Mr. Ogg then plunged a burning taper repeatedly into one of the vessels of oxygen, blowing it out as often as he withdrew it, and it was instantly re-lighted when it entered the vessel, where it burnt with greatly increased splendour, and would have been consumed in much less time than in common air. So powerful a supporter of combustion is *oxygen*, that bodies which require the heat of a furnace to fuse them under ordinary circumstances, if a lighted substance is first attached to them, and they are plunged into the gas, will melt and burn with the greatest intensity.

The experiment he was now about to perform was of a very striking nature, and in order to shew it in the best manner possible, it was necessary to fill a large vessel with oxygen. In accomplishing this, he was fearful that he should float the place with water, for owing to some defect in the pneumatic trough, it appeared to be of the best possible construction for spilling the water. A large jar was then filled with *oxygen* from a gasometer, and while the operation was going on, which occupied some time, owing to the inconvenience alluded to by Mr. Ogg, he explained the construction of Mr. Pepys, improved *gas-holder*, which stood at the other end of the lecture table, by means of which gases may be collected and transferred to smaller vessels with great facility.

The large vessel being now filled with oxygen, was placed before the lecturer, who produced a double coil of iron wire several inches in length, to one end of which a piece of cotton was attached. The cotton being lighted, the wire was plunged into the jar of oxygen, where it instantly took fire, and burnt with intense brilliancy. As the combustion of the iron proceeded, scintillations of vivid light darted abundantly in every direction, and innumerable small drops of the melted metal fell to the bottom of the vessel. It was unnecessary to state to the members the intense heat required to melt *wrought iron;* yet such was the powerful effect of oxygen as a supporter of combustion, and so intense was the heat of the globules of melted iron which fell to the bottom of the vessel in this experiment by their own specific gravity, that though they passed through an inch and a half of water before they reached it, they retained sufficient heat to melt the tin on the tinned iron bottom, and became imbedded in its surface. This beautiful experiment lasted a considerable time, and the perfect success with which it was performed elicited repeated acclamations from the numerous assembly.

From this experiment the lecturer took occasion to explain the theory of combustion, and observed that during the process the members had just witnessed, part of the *iron* entered into combination with the *oxygen*, and formed *oxide of iron*. If the experiment be performed in a close vessel, it will be found that the iron becomes *heavier*, and the oxygen *lighter*, the former gaining exactly as much in weight as the latter loses, and thus affording an evi-

dent proof that the formation of oxide of iron results from the combination of iron and oxygen. So great is the affinity existing between these two substances, that iron combines with oxygen without the aid of combustion, for the *rusting* of iron is its conversion into the oxide by combining slowly with the oxygen of the atmosphere.

The nature of combustion may be illustrated by a reference to what takes place in a common fire. When a portion of the cumbustible substance used is raised to a sufficient temperature, various portions of the combustible combine with various portions of the oxygen of the atmosphere, and different products result from these combinatio One portion of oxygen unites with the *hydrogen* of the burning body to produce *water*. Another portion of oxygen combines with the carbon of the combustible substance to form *fixed air*, or *carbonic acid gas*. A third portion of oxygen forms another combination, and produces the incombustible substance called *ashes*. But *heat* and *light* constituting *flame*, are also evolved during the combustion, and some difference of opinion exists respecting these products. It has been thought by some that the heat is supplied by the *oxygen*, which, not requiring so much *latent heat* in its new state of combination, gives it out, when it assumes the form of *sensible heat*, while the new combinations are going on in the process of combustion. Others have adopted new views on this subject, which it must be acknowledged is involved in some obscurity. By them it has been supposed that the heat and light result from the union of the two opposite electricities set free when the bodies combine together very rapidly as they do in combustion.

To shew how indispensibly necessary is the presence of oxygen in the process of burning or combustion, Mr. Ogg inverted a large receiver, filled with common air, over two lighted candles, the flames of which were at different heights. In this experiment, the candles consume the oxygen of the atmosphere, which enters into combination with them, and they are successively extinguished as the quantity of oxygen diminishes; the upper one going out first, and the lower one when the whole of the oxygen is consumed. It will be seen distinctly that as the oxygen is withdrawn from the atmosphere, the water in which the receiver is inverted, rises in its interior, and occupies part of the space previously filled with air. He had already stated that common air is composed of one-fifth oxygen and four-fifths nitrogen, and when the gas remaining in the vessel becomes colder, the water will occupy about one-fifth of the receiver, to supply the place of the oxygen which has been consumed. At present the water does not rise quite so high, because the gas in the vessel is expanded by the heat evolved during the combustion of the candles. In this experiment part of the *oxygen* combines with *hydrogen* to form water, which appears by the moisture deposited on the interior of the vessel; a small portion of carbonic acid is also formed; but the gas which remains is principally nitrogen.

During the process of combustion in a common grate, a supply of air is absolutely necessary. Many persons are anxious to exclude the air from every crevice of their rooms, not being aware that a continual accession of oxygen is essential to combustion as well as to respiration. It is however providential that air is capable of insinuating itself through almost imperceptible crevices, and thus baffles their endeavours to injure their own health. When a stream of air is directed against the fire, the combustion increases, because a larger portion of oxygen combines with a larger portion of the combustible substances.

That a continual supply of oxygen is as essential to *respiration* as to *combustion*, is evident; for if an animal be confined under a receiver, under the same circumstances as the candles, its life would be as certainly extinguished as the flames of the candles were. Mr. Ogg here produced a glass receiver, under which a bird had been placed about an hour and a half before. It was then lively and well, but no additionnal air having been supplied, it gradually drooped and grew fainter and fainter, till at length it died. If however he had taken two birds, and confined one of them in *oxygen*, and the other in *common air*, the former would have lived three or four times as long as the latter. Perhaps some of the members might infer from this circumstance that oxygen was fitter for the purposes of life than atmospheric air, but this is a great error. It is the property of oxygen to stimulate the animal frame, and cause it to perform all its functions with much greater energy and rapidity. He had indeed been informed, that instances had occurred in which beneficial effects had resulted from breathing oxygen; and the reason assigned was, that the frame not possessing sufficient energy to get rid of disease, an artificial energy had been communicated by oxygen, which enabled the patient to throw it off. That such an effect should be produced seems founded upon rational principles; but without giving a decided opinion on the subject, the lecturer proceeded to point out the conse-

quences which must result from the unnatural excitation which would be produced in the system by breathing pure oxygen only, and the members might rest assured that his description was not exaggerated. If, then, a man respired oxygen alone, the circulation of his blood would be amazingly accelerated; it would rush with redoubled velocity through his veins, a wild ungovernable energy would be marked in his countenance and flash from his eyes;—his spirits would be elevated so as to appear like intoxication or delirium; he would manifest that elevation of spirits in every possible way, and then sink exhausted, the victim of excessive and unnatural excitement. As a taper burnt in oxygen emits a brilliant light for a short period, and is prematurely extinguished; so, if the atmosphere consisted entirely of oxygen, every substance used for the purpose of giving light and heat would, as soon as lit, blaze for a short time with intolerable splendour, and then be extinguished. The presence of *nitrogen* in the atmosphere seems therefore as essential in the grand economy of nature to moderate the effect of *oxygen*, as the interposition of *caloric* between the particles of bodies is to counteract the tendency which all bodies have to assume a solid form.

Having thus shewn that the presence of *oxygen* is essential to respiration, Mr. Ogg observed, that perhaps the members might wish to be informed how much of it each of them consumes in the course of the day. This fact has been ascertained by rigid experiments, from which it appears that every grown person inhales 1000 gallons of atmospheric air in every 24 hours. This quantity contains 200 gallons of oxygen, or 46,000 cubic inches, which by weight exceed 30 ounces. It is impossible to adduce a more powerful argument against over close apartments.

To illustrate the theory of *respiration*, the lecturer directed the particular attention of his hearers to two large diagrams, exhibiting back and front views of the *human* heart. Portions of the arteries represented in the diagrams were of a bright red colour, and other portions were darkly shaded; the former indicating the *arterial*, and the latter the *venous* state of the blood. The heart is divided into four cavities, called *auricles* and *ventricles*. All the blood which proceeds from the extremities is of a *dark purple* colour, and is emptied into the *right auricle*, from thence it passes into the *right ventricle*, by which it is impelled into the vessels of the lungs, where it undergoes an extraordinary change, and becomes of a *bright red* colour. After passing through the vessels of the lungs, where its colour is changed, it returns to the heart, and is conveyed through the *left auricle* to the *left ventricle*, the strong muscular contraction of which impels it to every part of the frame.

What then is the cause of the remarkable change of colour which the blood undergoes in passing through the lungs?—It was formerly supposed that the change was produced by its combination with oxygen in the process of respiration, and this opinion seemed to be confirmed by the fact, that dark venous blood, if agitated in a vessel with oxygen, becomes red; but this is not at present the prevailing theory. It has since been found that the quantity of *oxygen* inhaled during respiration, is excluded from the lungs in the state of *carbonic acid*, which contains its own bulk of *oxygen*. It has therefore been supposed that when the *oxygen* is spread over the lungs, it combines with the *carbon* of the blood to form *carbonic acid*, and that the blood, being thus freed from its *carbon*, assumes a red colour. This is the present theory, but it must be confessed that the subject is one of considerable difficulty, and like many other branches of science, is still involved in some degree of obscurity.

Before proceeding to other experiments, Mr. Ogg alluded to the statements he had made, of the very large quantities of oxygen which are consumed in the processes of *respiration* and *combustion*. It might very naturally be asked, how this great loss is repaired? and in reply to this question, he would say that Providence had effected this object in many ways, one of which was so admirable, that he could not pass it over in silence. The various herbs, shrubs, and plants, which are so delightfully and profusely scattered over the face of nature, are not only instrumental in the preservation of health, but are essential to the support of life itself. Plants possess a strong attraction for carbon; and it appears natural that this should be the case, if we consider that this substance enters largely into their composition. If heat be applied to a plant in a close vessel, it will be found that after its other constituents are separated by decomposition, a large proportion of carbon remains. It has been affirmed that every plant has in itself a chemical laboratory; and that after attracting the *carbonic acid*, which, from its specific gravity, remains near the surface of the earth, it decomposes it, retaining the *carbon* which is necessary for its own subsistence, and setting free the *oxygen* to purify the atmosphere. He was aware that this theory had been objected to by some phi-

losophers, who were incredulous upon any theory which illustrated the power and wisdom of the Creator; but to him it was evident that the vegetable productions of the earth were endued with the property of imbibing the refuse of the atmosphere, while they assisted in restoring the pure air upon which its capability of supporting life depended.

The next branch of the subject to which Mr. Ogg requested the attention of the members, was the agency of *oxygen* in producing changes in the appearance and in the properties of bodies. When it is considered that there are not more than between 50 and 60 simple substances in nature, the infinite variety of substances which we find above and below the surface of the earth must necessarily excite astonishment. It was his intention to exemplify the agency of oxygen in the formation of a large proportion of this variety, and while the vessels were being filled with the gas for that purpose, he would illustrate by a familiar instance, one of the ways in which this agency is exerted. When *lead* is melted, it at first presents a brilliant surface, which soon becomes tarnished and covered with *dross* as it is called, and by continuing the heat, the whole is converted into this substance. This is the first stage of combination between *lead* and *oxygen*, and forms *oxide of lead*. Let the heat be still continued, and the substance changes to a *yellow* colour, indicating that another combination with oxygen has taken place. By a further application of heat, a *red* substance is produced, and this is the last stage of the combinations of *lead* with *oxygen*. Who would imagine, continued Mr. Ogg, that this substance, (holding up a phial filled with *red lead*,) so totally different is its appearance from its original form, is nothing more than a mixture of *lead* and *oxygen*? In this manner oxygen combines with many other bodies, and not only causes a change in their appearance, but communicates entirely different properties.

The lecturer now proceeded to illustrate the production of *acids* by the union of *oxygen* with *combustible bodies*. Oxygen was formerly considered as the only agent in the formation of acids, and some of the acids which result from its combinations with combustible substances, are of a highly *corrosive* nature. A jar was then filled with oxygen from Mr. Pepys' gas-holder, and a portion of *phosphorus* being ignited, was plunged into the gas, where it burnt with great rapidity, evolving considerable heat, and emitting a light so intensely brilliant as to be almost insupportable to the eye. During the combustion of the phosphorus it combined with the oxygen, and filled the vessel with dense white fumes, part of which escaped and occasioned considerable coughing among the members who inhaled a portion of the vapour. These fumes consisted of *phosphoric acid*, which, by continuing the experiment, would soon have entered into combination with the water at the bottom of the vessel, and communicated a sour taste to it.

The jar was again filled with oxygen, and some *charcoal* was burnt upon it. The experiment was also of a very brilliant description; the vessel during the combustion of the charcoal being filled with scintillations of vivid light, and the resulting compound was *carbonic avid gas*.

A third experiment was then performed by consuming *sulphur* in a vessel of oxygen; the combination of the two substances producing *sulphurous acid*. Mr. Ogg here took occasion to explain the process by which *sulphuric acid* is manufactured on a large scale for the purposes of commerce, by burning *sulphur* and *nitrate of potash* in chambers lined with lead. The floors of the chambers being covered with *water*, the fumes enter into combination with it; after which it is evaporated till the specific gravity of the liquid solution is 1,8, or about twice as heavy as water.

Now to appreciate properly the extensive agency of oxygen in producing the inexhaustible variety of substances which are presented to our observation, it should be remembered that all the acids formed by its combinations with combustible bodies, attach themselves to other substances, and in their turn, occasion the formation of innumerable compounds, possessing as many different forms and properties. *Oxygen* is one of the most abundant substances in nature. The members are aware that it enters largely into the composition of water. It is also an important constituent of the atmosphere which surrounds us, and it is combined with animal, vegetable, and mineral substances, and it is a constituent part of the rocks which surround the globe.

Upon these subjects, concluded Mr. Ogg, my observations might be considerably extended; but the warning voice of the clock forbids me to trespass longer upon your patience, than to express my regret that my engagements compel me to absent myself from your meetings for a time, and I therefore, for the present, bid the members ADIEU!

The worthy lecturer, on withdrawing from the table, was greeted with reiterated acclamations, which testified in the strongest manner the gratitude of the members

for the able instructions he had communicated to them.

Dr. Birkbeck then announced that on Friday the 20th instant, the subject of the lecture would be a new method of drawing Curved Lines, by means of a machine invented by Mr. Jopling; and that on the following Friday it was probable that a scientific gentleman would illustrate the branch of mechanical science called Dynamics; a subject which had not yet been explained to the members, and which would hereafter be more copiously elucidated by Professor Millington, when he resumed his lectures at the Institution.

LECTURES FOR NEXT WEEK.

Wednesday, May 25. Mr. Lewthwaite's seventh lecture on Electricity.

Friday, May 27, The subject of this evening's lecture is not yet definitively settled.

PROGRESS OF THE LONDON MECHANICS' INSTITUTION.

It must be truly gratifying to the philanthropic observer, to mark the rapid steps by which this valuable Institution is advancing to maturity, and by every advance falsifying the idle predictions of its enemies. The number of its members daily increases, and the library has recently been considerably augmented by several advantageous purchases, among which is a complete copy of the Transactions of the Royal Society, from its origin to the present time, in a hundred and eleven volumes. The arithmetical and mathematical schools, for the instruction of the members in Arithmetic, Geometry, Trigonometry, Algebra, &c. have been in operation for a considerable time, and have been numerously attended by the pupils. A drawing master is now engaged, and the school of Perspective and Architecture will be opened in a few days.

To these elementary schools, which are specified in the Rules and Regulations, may be added the French schools, in which so large a proportion of the members continue to derive instruction in the French Language, upon Mr. Black's system, and under the able superintendence of that gentleman, together with Messrs. Reynolds and Jones.

So deeply impressed are Mr. Black's pupils with their obligations to him for the valuable instructions he has gratuitously communicated to them, that a numerous meeting was held at the office of the Institution, on Saturday evening last, to take into consideration the propriety of testifying their gratitude to Mr. Black by some appropriate present. At the particular request of the pupils, Dr. Birkbeck presided at this meeting; and after he had briefly explained the object for which it was called, several resolutions were unanimously passed, and a subscription was opened for the purpose of presenting to Mr. Black a handsome Silver Snuff-box, with a suitable inscription, expressive of the motives by which this tribute of respect was dictated. A committee was then appointed to carry the resolution into effect, and the meeting adjourned.

MECHANICS' INSTITUTIONS IN AMERICA.

Our trans-atlantic brethren, we are happy to observe, are emulating the example of this country by establishing Mechanics' Institutions for the scientific instruction of the operative classes. About twelve months since, a letter was received by the committee of the London Mechanics' Institution, from the secretary to the Franklin Institute, at Philadelphia, announcing its establishment on similar principles, and requesting any information which the committee could communicate respecting the conduct and management of Mechanics' Institutions in England. The requisite information was promptly forwarded to Philadelphia, and the letter alluded to was laid before the members of the London Mechanics' Institution at the next General Meeting, and received with the greatest applause.

We have now the satisfaction of laying before our readers the following letter, received a few days ago by Dr. Birkbeck, from Dr. Webster, of the Harvand University at Boston:—

Boston, United States, April 11, 1825.

Sir—The great interest you are known to have taken in promoting institutions for the instruction of mechanics, induces me, a stranger, thus to obtrude myself upon you.

Convinced that similar institutions may be of unspeakable benefit to the mechanics of this city, I have for some time been exerting myself to obtain all the information I can in regard to those in Europe, and have ventured to request of you any information you may feel disposed to afford. Should there be any pamphlet or set of re-

gulations, they would be peculiarly acceptable.

I have the honor to be,
With the greatest respect,
Your obedient servant,
To Dr. Birkbeck. J. W. WEBSTER.

This letter was communicated to the committee by the worthy President on Monday evening last, and instructions were immediately given for complying with the request it contains. Copies of the rules and regulations of the London Mechanics' Institution; of Mr. Brougham's pamphlet; and of the first Volume of the MECHANICS' REGISTER, will accordingly be forwarded by the earliest opportunity, together with other documents calculated to promote the object contemplated by Dr. Webster.

BURY MECHANICS' INSTITUTION.

We have perused with much pleasure a small pamphlet containing an interesting account of the origin and progress of the BURY ST. EDMUND'S MECHANICAL AND SCIENTIFIC INSTITUTION, which was transmitted to us, together with the first annual report, by Mr. C. J. Hand, one of the secretaries. In the letter which accompanied these documents, that gentleman observes, that as Bury is not a manufacturing town, the promoters of the plan consider themselves successful in having 120 members; and he adds, that their example has accelerated the establishment of similar institutions at Ipswich and Norwich. The following extract from the report will be read with much satisfaction by all who feel interested in the diffusion of science by the establishment of Mechanics' Institutions:—

"A twelvemonth having elapsed since the formation of this institution, it remains for the treasurer to lay before the members the state of its finances, and for the secretaries to recount its proceedings during the year. With unmixed feelings of satisfaction they proceed to the discharge of this duty; not only from the prosperity which has marked the progress of the institution, but because it also affords them an opportunity of publicly explaining its real object. As the obstacles which impeded its establishment are at length, however, surmounted, it would be useless now to advert to them, except for the purpose of shewing how much may be accomplished by perseverance. Political motives, though not openly avowed, were supposed by some to influence the projectors; others doubted whether it would be productive of any utility; whilst many imagined it was intended only to elicit the secrets of trade, and convert them to the benefit of the members. The proceedings of the institution will sufficiently shew that these opinions were erroneous, and the fact of the number of members having gradually increased from 5, 15, and 50, to 120, proves that these prejudices have been triumphantly refuted."

The report proceeds to give a list of the lectures, amounting to nineteen, delivered in the course of the year by Messrs. Breese, J. H. Payne, C. J. Hand, Denson, and Smith, the whole of whom are members of the society. The institution is at present deficient in philosophical apparatus; but the library already contains upwards of 120 volumes, besides several periodical publications, among which the MECHANICS' REGISTER is particularly valuable, in consequence of the copious reports it contains of the lectures at the London Mechanics' Institution. Of this fact, the concluding paragraph of the report affords sufficient evidence:—

"A complete course of lectures on Botany will be commenced by Mr. Denson on Tuesday the 3rd of May next, and continued on the first Tuesday in every month till October; on the intervening Tuesdays, *a lecture previously delivered at the* LONDON MECHANICS' INSTITUTION, or extracts from some scientific work, will be read. The winter course of lectures will commence with one on the steam engine, which it is expected will be followed by others on mechanics, optics, and electricity. With respect to botany, though a knowledge of this science is at present confined to few, it is a subject which combines utility with amusement; and by leading us to contemplate the works of Nature, supplies an endless source of instruction and delight.

"Not a tree,
"A plant, a leaf, a blossom, but contains
"A folio volume. We may read, and read,
"And read again—and still find something new:
"Something to please, and something to instruct."

The first anniversary meeting of the institution took place on the 12th ultimo, when Mr. J. Mathew being called to the chair, the report was read by one of the secretaries, which gave a summary of the proceedings during the year, and the present state of the institution. It recommends that apparatus for the lectures should be procured, as it would render them far more interesting, and a quadrant and pair of globes are all now belonging to the institution. About 70 volumes have been presented to the library, and a catalogue will shortly be published, with the names of the donors, by which period, it is hoped, a considerable addition will be made. The donations amount to upwards of 25*l.*, and the subscriptions to 45*l.*, and a trifling balance remains in the hands of the treasurer. At the conclusion of the report it was notified that arrangements were made for lectures on Botany, Mechanics, and Optics, and we since understand that some on Chemistry may soon be expected.

The first resolution, that the report be adopted and printed, was then unanimously agreed to, as were also all the others.

It was next moved, that the thanks of the meeting be given to those gentlemen who have patronised the institution by donations and loans.

Mr. William Smith now submitted some remarks, which he thought applicable to the resolution just passed. He noticed the gratifying support the institution had received, and pointed out the advantages it offered to mechanics, whose improvement not only added to their own comfort, but the wealth and prosperity of the nation. He then took a comprehensive view of the various inventions we owed to the ingenuity of the mechanics, and observed that the superiority they enabled us to maintain rendered that class, in his opinion, particularly deserving of encouragement.

Thanks were also voted to the treasurer and auditors, to the committee, to the members who have favoured the institution with lectures, and to the chairman.

Upon thanks being voted to the committee, Mr. C. J. Hand expressed his gratification that the manner in which they had discharged their office was considered worthy the approbation of the members. After adverting to the satisfactory progress of the institution, and dwelling at some length on the benefits likely to result from that, and others of a similar nature, he concluded by pointing out the advantages which must necessarily attend a more general diffusion of knowledge.

Auditors were then appointed; and a committee, including the treasurer and secretaries (who were re-elected), chosen for the year ensuing.

A number of the members afterwards dined at the Greyhound Inn, where several appropriate toasts were drunk, and the evening was passed with a spirit of harmony and conviviality, highly gratifying to all present; but, at the same time, with a rational attention to decorum which would have done credit to any society.

We cannot conclude this account without expressing our sincere wishes for the continued prosperity of an institution, which affords a striking example of the good which may be effected by the persevering exertions of a comparatively small number of individuals. We trust that the example will be followed in many other places, where the mechanics may have hitherto hesitated, from an apprehension that nothing could be done without the co-operation of very large numbers.

DUBLIN MECHANICS' INSTITUTION.

On Wednesday, the 11th instant, there was a very numerous attendance of the members of this most valuable institution, upon the occasion of the commencement of a course of lectures on mechanical and experimental philosophy, by the Rev. Dionysius Lardner, of Trinity College. It was truly gratifying to observe, that a great majority of those present were working mechanics who evinced their desire of instruction, whilst the profound attention with which they listened to the learned lecturer, and the spontaneous applause that followed the demonstration of the several problems, bespoke a natural discrimination and capability of comprehension, from which may be augured the happiest results.

The rev. and learned lecturer set out by observing upon the difficulty he had to encounter, in relinquishing that scientific and technical style of expression with which long habit had made him familiar.—He was, he said, aware that many persons present were perfectly acquainted with the necessary scientific terms, but his observations and instructions to be useful to those for whom they were intended, and whose education had not made them familiar with those technicalities, should be conveyed in language, the very opposite, and that which it had been long his aim and study to adopt on the same subject elsewhere (when addressing his pupils in the University.) This

was a difficulty which could not easily be conceived, and although he should abstain as much as possible from the use of those terms, yet, to dispense with them altogether, would be inconsistent with the subject upon which he was about to enter. In the course of the week, he should have all the necessary technical expressions defined in popular language, as far as would be practicable, and those who were desirous of availing themselves of the information to be conveyed by his course of lectures, should make themselves perfectly familiar with those definitions.

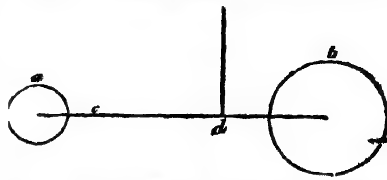
The learned gentleman then proceeded to observe, that it had been his original intention to embrace in his course the whole range of mechanical science—but, upon maturer consideration, it occurred to him, that such a scheme would require too much time, and too great a store of previous mechanic and scientific knowledge in those to whom he should address himself. He had, therefore, determined to confine himself more particularly to the elementary principles of mechanics connected with the useful arts. He, however looked forward with strong hopes to a more prosperous state of the institution, when he should address such assemblies as had sprung up in England, Scotland, and France. There had been, the reverend and learned gentleman said, a meeting of the Mechanics' Institute in Paris, a few weeks since, at which 500 persons were present, and what was still more delightful, they were all of the working classes. (Loud applause.) The learned gentleman then proceeded in his lecture, which, as we before stated, was listened to with the most profound attention, and the audience afterwards separated in perfect quiet and good order.

MR. WALLIS'S REPLY TO ASTEROID.

To the Editor of the Mechanics' Register.

SIR—In a recent number of your valuable REGISTER, I am indebted to your correspondent Asteroid, for some critical remarks on my astronomical lectures, delivered before the members of the Spitalfields Mechanics' Institution, accompanied at the same time with the most liberal commendation. While I acknowledge the kind feelings with which his praise is given, I trust he will not misconstrue my reply, if in it I prove the validity of those illustrations to which his objections refer. My delay in noticing his remarks has arisen entirely from my absence from home.

The experiment is detailed in No. 26 of your REGISTER, in which I showed that it was impossible to make the larger ball *b* revolve round the smaller ball *a*, unless the smaller one were fixed to something considerably heavier than the two balls, and the wire *c* uniting them. This I used to exemplify the motion of the earth about the sun, by suspending them at the point *d*,



their common centre of gravity; the larger one representing the sun, the smaller the earth, both being of the same specific gravity. But your correspondent says, "we cannot be assured that the specific gravity of the sun does not differ as widely from that of our earth, as their distance from each other." Now it is evident that this comparison expresses no ratio of distinction, for the earth is just as distant from the sun, as the sun is from the earth. If this be meant as his argument, my experiment must consequently be admitted as conclusive.

However, to invalidate my illustration, we must *suppose* the densities of the sun and earth inversely as their respective magnitudes. Now the mean density of the earth inferred from many elaborate experiments, is found to be about 4¾ times that of water; the bulk of the sun is 1,370,000 times that of the earth: hence if their masses be supposed equal, the density of the sun must be about 300,000 times less than water; the solar substance will therefore be 600 times lighter than pure hydrogen gas,—rather a daring supposition! And *now* we shall only make them describe circles of equal diameter about their common centre of gravity: But if our argument is to proceed on supposition, why may we not at least suppose their densities equal? This kind of procedure was however the bane and darkness of the old philosophy, and since by the sage and prophetic advice of Bacon, experiment and analysis have been adopted, Nature has ever unfolded her secrets to the scrutiny of man.

By the profound researches of mathematicians, founded on the mutual perturbations of the respective planets, and from the motions of their satellites, it has been ascertained, that the density of those planets is greatest which are nearest to the sun. That the density of the moon is somewhat less than the density of the earth—and that

the density of our own planet, is about four times that of the sun. Hence the mass of the sun is about 329,360 times that of the earth. The common centre of gravity about which the earth would revolve, were there no other planets, would be no more than 300 miles from the centre of this immense luminary. But if we suppose all the planets to be at once on the same side of the sun, the centre of gravity of them all and of the sun, would be the centre of the solar system: but the sun would not be removed a distance from this point equal to his own diameter, so greatly does his mass surpass that of all the planets united. The largest planets being also most remote from the sun, is a circumstance, which besides their mass, contributes very much thus to displace him from the centre of the whole system. I trust then by a reference to my experiment as detailed by your correspondent, it will be immediately seen that I did not avail myself of the full advantage of the fact; and that I "*have* taken care that my illustrations were *not* at variance with the principles they were designed to elucidate," a precaution involving the very lowest degree of merit in a lecturer. I think, Sir, it will be manifest to the good sense of your correspondent, that had I, in my introductory lecture, submitted all these intricate data, to my inerudite, but most worthy auditors, I should not have been as I was throughout, indulged with a silence and inquisitive attention which would have done honour to the most fashionable assemblages of our scientific institutions.

But while objection is brought against this experiment, the one which followed on the whirling table, seems to have given complete satisfaction to Asteroid; this is very strange, as it proceeded on the same facts and principles as the former. Having shown two bodies of unequal masses in motion, in equilibrio, about their common centre of gravity, I wished to show that any foreign momentum added, must be communicated at the centre of gravity, or the centrifugal force would accumulate on one side only, and equilibrium would cease; I therefore was compelled to resort to the whirling table, in order to displace the centre of gravity from the centre of revolution, and thus show the destruction of that system of motion that had been attempted, proving thereby the unalterable nature of the laws of centrifugal force, that momentum being added on either side of the fulcrum, is equivalent to matter being added.

If one of two bodies mutually attracting, be made to revolve round the other, the only condition of equilibrium is, that the momentum of each be equal; their respective circles of revolution, and their velocities, must therefore be inversely as their masses; this will follow from the equality of action and reaction. This appears to me to be the broad and immoveable basis of the *Principia* of Newton, and the ultimate argument of the *Mechanique Celeste* of La Place. The sublime aim of the sagacious genius of these great men, is to identify in motion, throughout the wide range of the material universe, the laws of Dynamics, by showing, that by the agency of the same simple and immutable laws, familiar to us in the science of mechanics, the celestial motions are maintained, and their harmony perpetuated; thus circumscribing the immeasurable amplitudes of space by one golden chain, whose links unite the most remote and stupendous masses of the universe with the small imponderable dust of the balance; and by their penetration, disclosing to us, that the same principle which governs the motion of the atom that falls unfelt upon the hand, actuates the elemental movements of the vast and complicated machine of universal nature.

Your correspondent avows himself an advocate for the Copernican system:—admitting then the famous theorem of Newton, by which the amount of the deflection of the moon from a tangent to her orbit in one minute of time, is shown to be occasioned by such a force, as that which causes bodies at the earth's surface to descend 16 feet in one second, if it were diminished in the inverse ratio of the square of the moon's distance,—if this be admitted, and the same principle be applied throughout the solar system, then the mass of the sun must be such, as by his revolution about the centre of gravity, to furnish a centrifugal force with respect to each of the planets sufficient to counteract the effect of his attraction. His mass therefore must greatly exceed the aggregate mass of *all* the planets.

The beautiful arrangements of Pythagoras and Copernicus were highly important facts, as they excluded perplexity and confusion from the motions of the planets, and accounted in the simplest manner possible for many of their variable appearances. The discovery of the aberration of light supplies a complete confirmation of the correctness of this arrangement; but the comprehensive generalization of Newton, by which all the phenomena of their motions are reduced to the great and universal principle of gravitation, is the only step that enabled us to class astronomy properly among the sciences of natural philosophy. By the aid of his great argument, we are

able to discover, that what we call the *perturbations* of the system, are as much evidences of the truth of his hypothesis, as the more uniform motions themselves; these perturbations being such only in reference to those arbitrary arrangements and classifications, which, from the contracted character of our faculties we are compelled to adopt. They are indeed the actual details of the very laws of centrifugal and centripetal forces, exemplified in relations and combinations infinitely varied, and incessantly changing, in a system composed of so many parts in motion, and which are too evanescent and subtile to be included in our general formulæ.

Your correspondent's remarks relative to the weight of the earth, are nearly agreeable to my own opinions. But he has forgotten, or perhaps did not notice, that I determinately stated that the only manner in which we can speak of the weight of the earth, is, as the force with which it is impelled in its orbit about the sun, the earth therefore has weight in the direction of the motion in the orbit. My lectures being quite extemporaneous, I cannot affirm these to have been the words employed on that occasion, but I remember making a statement to this amount. It is my general habit to make my assertions as definite as possible at first, and to qualify them afterwards by any necessary limitations or exceptions.

The *total momentum* of the earth is its weight; now this is compounded of the solar attraction and the projectile force, and cannot, as Asteroid states, be in the direction of the sun, but is of course always in the direction of the earth's motion in its orbit. As these forces vary, its weight will vary also. This is the case with bodies at the surface of our own planet, as they change their latitude; the rotatory centrifugal force being to the attraction of gravitation on them, what the projectile force of a planet is to the centripetal force of gravitation in the sun.

The science of astronomy is hypothetical, and it will be found by those who endeavour to teach it by lectures, that the total evidence in proof of any one fact cannot be given at once by any mode of arrangement. The force of hypothetical argument is always accumulative, depending intimately upon deep reflection. Let any one peruse the Principia, and he will find that it is when he has compassed that universe of thought, that he will perceive the profound depth of its early pages. The experiments of the lecturer are directed by his total knowledge of the whole science, and therefore can only impart in degree the truth, which to his mind they exhibit. More especially in astronomy in which our experiments can only illustrate not demonstrate the facts to which they refer. They may serve to exemplify the agency of forces in *kind*, not in *degree*. Hence investigations in this science involve much abstracted thought, and require considerable exercise of the imagination to extricate the truth or fact to which any experiment may refer, from the extrinsic circumstances by which it is unavoidably encumbered.

I am, Sir, your obedient servant,
JOHN WALLIS.

Albany Road, Camberwell,
May 12, 1825.

REMARKS ON MR. PARTINGTON'S ILLUSTRATIONS OF THE MARQUIS OF WORCESTER'S CENTURY OF INVENTIONS.

To the Editor of the Mechanics' Register.

Sir,—It may seem presuming to call in question the high authority which represents Mr. PARTINGTON as having "elucidated the obscure hints of the Marquis of Worcester in so satisfactory a manner." But I trust you will excuse my expressing a doubt, whether Mr. P.'s solution of No. 6 of the Marquis's Century of Inventions, can fairly lay claim to that title.

The "*Note*" in your 29th Number is, I presume, Mr. P.'s explanation of the problem, which, he seems to think, is solved by suggesting that the *Telegraph* is alluded to by the Marquis. But I should be glad to know, how a correspondence can be carried on between two persons, "ex re nata," and without any "preparation beforehand" by means of a *telegraph*, which, as at present practised, requires a previous knowledge of the meaning expressed by the different combinations of that machine. The latter part of No. 6 seems to point more directly to the telegraph, but it gives us no insight into the manner by which "a man may hold discourse with his correspondent" *without* "premeditated course taken by mutual consent of parties."

An explanation of this difficulty will much oblige several of your readers, and more particularly your obedient servant,

Y. M.

*** In vindication of the justice of our remarks on Mr. PARTINGTON's interesting work, as well as of our own "high autho-

rity," so politely acknowledged and disputed in the same breath by our worthy correspondent, we beg to observe, that Mr. Partington did not intend to assert that the Marquis of Worcester had invented telegraphs used in the manner "*as at present practised*;" because *secrecy* in the communication has been lately added to *celerity*. But it is obvious that the word "*telegraph*," which merely signifies *writing at, or for a distance*, does not include this political essential. If Y. M. will make himself conversant with the various modes which, within the last 30 years, have been proposed for the construction of telegraphs, he will find that some of them have consisted of contrivances for forming at pleasure representations of the different letters of the Roman alphabet; some by means of moveable arms, and others by uncovering apertures in solid planes of wood, so as to leave the form of the letter visible in the several perforations. Words composed of such letters may evidently be read at any distance to which the powers of the telescope can extend, by two persons without any "preparation before hand," excepting a mutual agreement to become observers of each other's writing. We hope that this explanation will be deemed satisfactory by our correspondent. and that he will allow us to remain in undisturbed possession of the "high authority" aforesaid.—Ed.

NEW STATE COACHES.

We have been gratified with a view of a superb State Coach, just completed by Messrs. Barker and Co. of Chandos-street, for his Excellency Viscount Granville, our Ambassador at the Court of France, which for neatness and elegance has perhaps seldom been surpassed. The pannels are a rich Brunswick green, with his lordship's arms, &c. beautifully emblazoned. On the roof are two rows of coronets on cushions, which, with two costly embossed lamps, the cornice of oak leaves and acorns, the body-loops of serpents springing from tufts of grass, mouldings and other carved ornaments, are all richly gilt, and have a very pleasing effect. The lining is of green satin and gold-coloured silk lace; the interior roof is embroidered with an emblematical device of the rose, thistle, and shamrock. The hammer-cloth is scarlet, tastefully festooned with gold-coloured fringe and bullion tassels; the arms chased and gilt at each end, on purple velvet. The carriage and wheels are carved and gilt on a green and red ground; and there is also state harness for six horses to match. Indeed, the whole may be considered a splendid proof of the superiority of the arts in this country.

Messrs. Barker have also an elegant equipage in great state of forwardness for Prince Esterhazy, which, we think bids fair to rival the preceding. They are both to be used at the coronation of Charles X. and will be shipped in a day or two.

TO CORRESPONDENTS.

Mr. Wallis is requested to accept our best thanks for his able and gentlemanly reply to Asteroid.

We regret that want of room obliges us to postpone the insertion of Mr. Marsh's valuable communication till next week. We feel much obliged by the intimation contained in his postscript, and shall be happy to avail ourselves of his kind offer.

D. Thomas, on the Dip of the Magnetic Needle, is intended for insertion.

A description of a Portable Vapour or Steam Bath will appear in our next.

We are obliged to our Protean correspondent, Opifici Amicus, for his good opinion. His answer to G. T. P. will appear next week.

Mr. Palmer's communication, respecting the London Friendly Institution of Mechanics, will be attended to in the next number.

Answers to several Queries will also appear in our next publication; and we invite our numerous readers to exercise their ingenuity in replying to those questions which remain unanswered. Much valuable information may, by this means, be communicated to the public; and we trust that no apprehension of inability to express their ideas with strict grammatical precision will deter the humblest operatives from transmitting their observations. The diamond, though unpolished, possesses the same intrinsic value, and we shall willingly devote ourselves to the task of polishing the roughest gem that may be confided to our care.

Errata.—Our readers are requested to observe, that the two last lines of page 18, col. 2, were inadvertently misplaced in a great part of our last week's impression. They should therefore be omitted in that page, and added at the bottom of page 22, col. 2. Page 29, col. 2, line 59, for "*un*" read "*un*;" and line 31, for "he is not like his father," read "he is *not not* like his father."

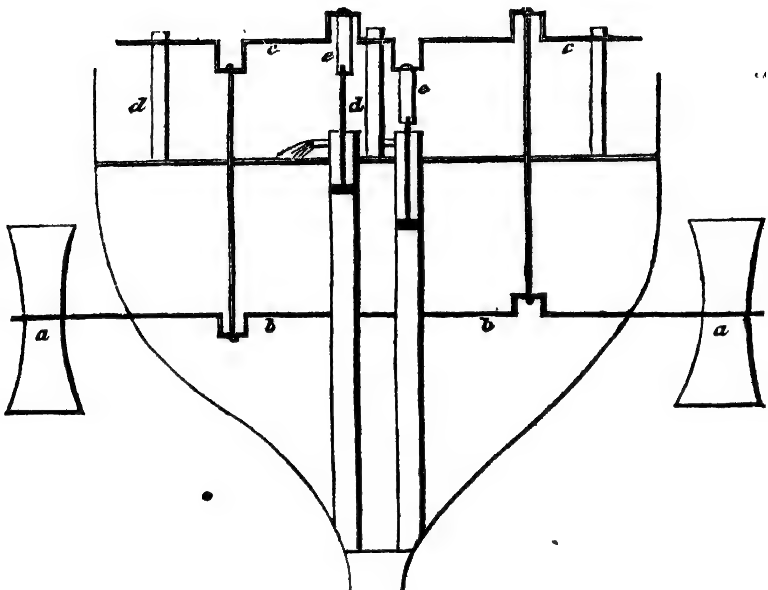
LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communications *(post-paid)* requested to be addressed.
Sold by SHERWOOD, JONES, & Co., Paternoster Row; and may be had of all Booksellers and Newsmen.
Also, Sold by A. & W. GALIGNANI, No. 18, Rue Vivienne, Paris; C. WILEY, New-York; CARFRAE, Rio Janiero.

THE LONDON
MECHANICS' REGISTER.

" How rude soe'er the exterior form we find,
" Howe'er opinion tinge the varied mind,
" Alike to all the kind impartial Heaven,
" The sparks of truth and happiness has given.' GRAY.

No. 32.] SATURDAY, MAY 28, 1825. [Price 3*d*.

IMPROVED METHOD OF WORKING SHIPS' PUMPS



To the Editor of the Mechanics' Register.

Sir—Perceiving that your valuable REGISTER is open to all kinds of improvements and discoveries, however humble, allow me, through that medium, to present to your readers an improved method of mine (I conceive it to be so, never having heard of the like) for working ships' pumps. It often happens that vessels which are leaky will keep their pumps constantly at work, both on their passage out and home; my plan is therefore to obviate as much as possible the labour and fatigue which our mariners have to undergo in such cases. By allowing the enclosed a place in your valuable REGISTER, you will oblige,

Your's respectfully

Rotherhithe. R. LEWTHWAITE.

The paddle wheels *a a* are connected by the shaft *b b* which is bent at right angles forming cranks, and is connected with the upper shaft *c c*, which is also bent at right angles in four different places; *d d* supports to the upper shafts; *e e* pump irons to cause a perpendicular motion during the rotation of the cranks *c c*, by being freely suspended. Now it appears evident, that if the ship makes any way it will cause the paddles to rotate, and thereby work the pumps.

P. S. I think the whole of this apparatus might be made to take to pieces, and would occupy but a small space. R. L.

*** The insertion of the preceding communication has, from the pressure of other matter, been deferred for several weeks, and in the interim, the writer was informed that a suggestion of a similar nature had

appeared a short time since in a contemporary publication. As Mr. Lewthwaite, jun. was anxious to avoid the imputation of plagiarism, he requested, with a feeling highly honourable to himself, that we would not insert his letter; but having since read the article alluded to, which merely conveys a brief intimation of the practicability of working a ships' pump by means of an exterior water-wheel, without pointing out the mode of connecting the wheel with the pump, or elucidating the apparatus by a drawing, we are of opinion that it would be an act of injustice to the inventor and the public to withhold it. The subject appears to us to be of considerable importance, and the plan proposed by Mr. L. at once ingenious, simple, and efficacious; and as the extensive circulation of our pages may increase the probability of its adoption, and we entertain no doubt that Mr. L. is justly entitled to the merit of the invention, we feel no hesitation in recording it as another instance, in addition to many similar coincidences, of the occurrence of the same idea to different individuals, without the knowledge of each other. – ED.

LONDON MECHANICS' INSTITUTION.

MR. LEWTHWAITE'S SIXTH LECTURE ON ELECTRICITY.

EXPERIMENTS WITH THE ELECTRICAL BATTERY CONTINUED—ITS EFFECTS ON THE METALS—OXIDATION OF GOLD, SILVER, COPPER, STEEL, PLATINA, &c. —LUMINOUS EXPERIMENTS.

WEDNESDAY, 18TH MAY.

Mr. LEWTHWAITE commenced the present lecture by observing that as, in his previous discourse, he had introduced a number of experiments with the Leyden jar, and after explaining the construction of the electrical battery, had concluded by shewing its effects on the animal economy, he should now resume his experiments with the battery, for the purpose of exhibiting its operation on the metals. He would in the first place throw the oxide of gold leaf upon paper, and shew that this experiment might be rendered very amusing by producing profiles and other figures upon the paper, and would afterwards explain the manner in which the apparatus was arranged to produce this effect.

The battery was then arranged upon the lecture table, and having been powerfully charged, the shock was directed through the gold leaf previously prepared, and a distinct portrait of his late Majesty instantly appeared upon the paper to which the gold leaf had been attached. The battery was again charged and discharged several times, and the representation of an eagle and other figures having been produced, were handed round for the inspection of the members. The devices formed upon the paper by the dark and shadowy appearance of the oxide, were well defined, and afforded much satisfaction to the audience.

Mr. LEWTHWAITE then explained the nature of the experiment by stating, that a leaf of gold is first laid upon a piece of paper, and upon the leaf is laid another piece of paper, from the middle of which the portrait, or other device has been previously cut out; over this is laid a third piece of paper which is to receive the impression from the second, containing the device. The papers are then pressed between two pieces of glass, and the whole being placed between the poles of the universal discharger, the shock is passed through it. The powerful action of the electric fluid upon the gold leaf strikes the oxide upon the paper; but as only that part of the leaf which forms the device is exposed to its operation, the figure cut out of one piece of paper is distinctly formed by the oxide upon the other. As many persons may not be able to procure plates of glass for this experiment, it may be necessary to state, that two pieces of perfectly smooth mahogany will answer the purpose; but to form a ready communication, a piece of tinfoil should be placed upon one of the pieces of paper.

If a piece of gold leaf be placed between two plates of glass, and the shock passed through them, the gold will be struck completely into the glass, provided the battery is sufficiently powerful. Mr. Lewthwaite observed that he was apprehensive the battery on the table, consisting of four jars only, was not strong enough to produce this effect, and there was not sufficient room to construct the whole of the battery in the possession of the Institution. The experiment was, however, tried; and after the shock had been passed through the plates, one of them was handed round, upon which a portion of the oxide of gold was distincly visible, though the effect was not so complete as would have been produced by a more powerful shock.

The lecturer then exhibited a sheet of paper upon which four wires were extended, viz steel, copper, silver, and platina. As these wires did not exceed the 500th part of an inch in diameter, they could not be distinguished by the members; but as he was about to oxidate them by means of the battery, the oxides would be distinctly visi-

ble upon the paper, if he succeeded. He should however observe that the experiment was of a very delicate nature, and to insure its perfect success, a series of experiments with the battery was necessary, in order to ascertain its exact power in relation to the length and thickness of the wires employed. As he had not been able to avail himself of any opportunity to institute this previous inquiry, he trusted that he should, under those circumstances, escape blame if the experiment should fail.

The result proved that the worthy lecturer's apprehensions were unfounded, for upon exposing the wires in succession to the shock of the battery, the oxides of the different metals were all distinctly struck upon the paper, which was handed round to the members, and presented a very curious appearance. The lines formed by the oxides upon the paper were of different colours and of various degrees of intensity, according to the metals employed, and the edges of the whole of them were clouded, irregular and indistinctly defined.

A piece of very fine steel wire was then immersed longitudinally in a glass vessel of water, in order to shew that though it was thus kept cool by the water, the shock was capable of melting it in that situation. The battery being discharged through it, numerous bubbles of air arose from the water, and the whole of the metal was completely dissipated.

Mr. Lewthwaite now directed the attention of his hearers to a large black board behind him, across which he had extended four wires, each about three feet in length. These wires were gold, copper, silver and steel. With the whole of the electrical battery of the institution he had no doubt he could explode 30 feet of wire, and the members would be convinced of this fact, if he succeeded in exploding three feet by means of the four jars on the lecture table. The room was then darkened that the effect of the explosion might be more distinctly seen, and the communication being formed with the wires, the shock was passed through them in succession. The whole of them were successfully exploded, and at each discharge, a stream of vivid light flashed along the wires, and caused the copper and steel wires to fall in a complete shower of red-hot metal, which exhibited a very beautiful appearance, and elicited the greatest applause from the members.

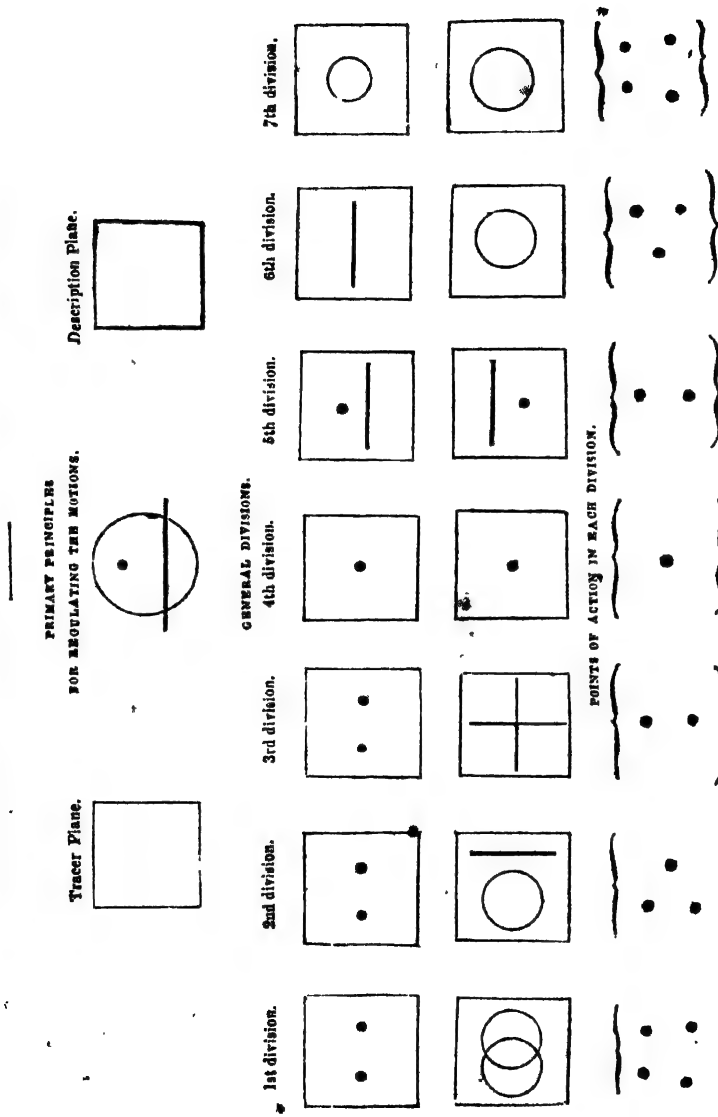
The lecturer then performed three interesting experiments by passing the shock of the battery through carbonate of lime, or common chalk, carbonate of barytes, and loaf sugar. The lecture room was rendered as dark as possible, and Mr. Lewthwaite recommended the members to shut their eyes till they heard the discharge of the battery, as the beautiful phosphorescent appearance of the substances would be seen more distinctly if the eye avoided the brilliant flash of the spark. We cannot inform our readers whether the lecturer's advice was generally complied with by the audience for the following important reasons, viz. first, because we shut our own eyes; and secondly, because the room was so dark that we could not have seen if we had kept them open. Suffice it to say, that by adopting the suggestion of Mr. Lewthwaite, we distinctly observed the phosphorescent light communicated to the three bodies by the shock, and from the general applause which followed the experiments, we have no doubt the whole of the members participated in our satisfaction.

Some other experiments of a luminous, but not of a phosphorescent nature remained to be performed; and as it was rather a laborious task to charge the battery so repeatedly, and a single jar was sufficiently powerful to produce the intended effect, Mr. Lewthwaite caused three of the jars to be removed from the lecture table. It was always a rule with him to perform his experiments with the least possible power. In those already exhibited the battery was necessary, but if he were to use so large a power in the remaining experiments, he should mislead the members by inducing a belief that a less power was insufficient. Three eggs, and afterwards 3 oranges, were then placed above each other in an open frame, and the electric fluid was repeatedly passed through them, when they assumed a beautiful luminous appearance.

The concluding experiment was extremely striking and brilliant. Two high poles had been previously fixed at some distance before the lecture table, and between them a long steel chain was fancifully suspended in numerous festoons, very tastefully arranged. A communication having been formed between the chain and the jar, the spark was passed, when the whole of the chain became instantaneously illuminated, and flashed upon the spectators in festoons of vivid fire. The members were gratified by a repetition of the experiment, which was hailed with reiterated acclamations.

Mr. Lewthwaite concluded by observing, that as he had now illustrated the formation of metallic oxides by means of the electric shock, and had also exhibited the phosphorescent and luminous effects produced by the fluid, he trusted the members were prepared for the consideration of the next branch of the science, viz. atmospherical electricity, which he should endeavour to illustrate on the succeeding Wednesday.

SEPTENARY SYSTEM OF GENERATING LINES BY SIMPLE CONTINUOUS MOTION.



MR. JOPLING'S LECTURE ON THE SEPTENARY SYSTEM OF GENERATING LINES BY SIMPLE CONTINUOUS MOTION.

FRIDAY, 20TH MAY.

On entering the lecture room, we were struck with the appearance of a number of large diagrams, covering a space of about 15 feet by 10, in front of the audience. As these diagrams collectively exhibit the *primary principles*, and the *seven general divisions* of Mr. Jopling's system, we are happy to be enabled to present a correct copy of them to our readers on the preceding page.

It may be necessary to observe, that Mr. Jopling's ingenious apparatus consists of two square planes of equal size, one of which is fixed while the other is in motion. The lower plane, to which is attached the pencil which traces the various curves, is called the *tracer plane;* and the upper one, upon which the curves are described, is called the *description plane.* Between these planes, sunk in a groove in each, is placed the brass apparatus by which their motions are regulated; and as the nature of the curve to be described depends upon the number of points of action, and also upon the various directions in which the action is communicated, the internal apparatus is adjusted accordingly, and the planes are then placed upon each other. To the *lower*, or *tracer plane*, a graduated moveable slide is screwed, which passes horizontally across the *upper*, or *description plane*, and at the extremity of this slide the *pencil* or *tracer*, is fixed perpendicularly, with its point resting upon a sheet of paper laid upon the description plane. The upper plane is then put in motion, and as it necessarily follows the direction communicated by the internal adjustment, the point of the pencil describes the required curve on the paper. It may also be remarked, that if the upper plane be kept fixed, while the lower one is put in motion, precisely the same curve will be described; the only difference being, that in the former case the paper moves under the pencil, and in the latter, the pencil moves over the paper.

Mr. Jopling commenced his lecture by observing, that as this was his first attempt to communicate his ideas in public, he must request the kind consideration of his audience, if the mode he intended to adopt should not at once convey to their minds so comprehensive an idea as he could wish of the extent and importance of his subject. The system of which he should now have the honour of endeavouring to give a general explanation, he had denominated "The septenary system of generating lines by simple continuous motion."

It was his intention, previous to entering upon a description of this system, and the apparatus connected with it, to have noticed other instruments, and the organical description of curved lines by other methods, as well as the time when, and by whom, these methods were invented. This idea he had abandoned, from an apprehension that it would occupy too much time; and, for the same reason, he should not, at present, enter into any detail of the utility of his invention, but should notice a few applications of its principles in the course of his explanation, and conclude by reading a testimonial in its favour.

"The SEPTENARY SYSTEM, continued Mr. Jopling, is a classification of the *primary principles* by which two planes may be connected together, so that while one plane is at rest, the other may have a regulated motion, and a tracer fixed to either plane will describe a fair line upon the other plane.

The principles considered *primary*, are,
First, a point, or pole;
Second, a right line; and
Third, a circular line.

Very little has hitherto been known of these simple principles in regulating the motion of a plane, and far less of the gradual connections, the harmony, and infinite variety in their effects. That every member of this institution may clearly understand me, it may be necessary to give the definitions of a few terms, and also to mention a few axioms.

DEFINITIONS.

1. By a *pole*, I mean a point which tends to regulate the motions of a plane.

2. By a *right line*, a straight ruler or groove.

3. By a *circular line*, the circumference of a wheel, or the line described by the pole of a crank.

4. By a *plane*, a table or plate perfectly flat and inflexible.

5. A plane is called the *tracer plane*, when to any part of it a tracer or point that describes any line is fixed.

6. That plane is called the *description plane*, on which the tracer describes any line.

AXIOMS.

1. A pole may slide along a right line.

2. A right line may slide against a pole.

3. A right line may slide along a right line.

4. A right line may, by a rolling motion

touch in succession all the parts of a circular line.

6. There is one exception to the last axiom; equal parallel circles cannot *roll* the one against the other; the motion is *sliding*.

7. The motion of any two points of a plane being regulated, the motion of the whole plane is regulated.

8. Whether the tracer plane be the *moving* or *fixed* plane, the same line is described by the tracer on the description plane.

The number of general divisions of the system, as the name implies, are *seven*, and the order of gradual connection proceeds each way from a centre, thus:—

4 3 2 1 2 3 4

In describing the several divisions, instead of beginning with the middle, or most simple, and proceeding to the left; then returning back to the middle and proceeding to the right, it has been thought better to begin at one extremity of the scale, and proceed in the order of the first seven digits, and from these the divisions are named.

(These remarks, as well as the following description of the seven divisions, will be understood clearly by a reference to the diagram, in which the two planes are placed above each other in each division, and the primary principles employed, whether *points, right lines*, or *circular lines*, are described upon the planes according to their various combinations. Below the two planes in each division is seen the number of points of action, increasing each way from the centre, as stated above by Mr. Jopling.)

The lecturer then particularised the various divisions as follows, pointing them out to his hearers as he proceeded, by reference to the series of diagrams exhibited:—

First division—Two poles on one plane; two circular lines in another plane.

Second division—Two poles on one plane; and a right line and a circular line on the other.

Third division—Two poles on one plane; and two right lines on the other plane.

Fourth division—A pole on one plane, and a pole on the other plane.

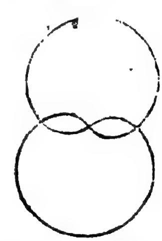
Fifth division—A pole and a right line upon one plane; and a pole and a right line upon the other plane.

Sixth division—A right line upon one plane; and a circular line upon another plane.

Seventh division—A circle upon one plane; and a circle upon the other plane.

After this general description of the seven divisions, Mr. Jopling stated that he would endeavour to shew the action of the first division; but if he employed two planes, as actually used in the apparatus which was lying on the table, the action by which its motion was regulated could not be seen by the members. He therefore directed their attention to a large black drawing board fixed perpendicularly upon the platform, in the front of which was placed a strong open frame. The bar at the top of this frame being fixed, was supposed to represent a portion of the *fixed plane* of the apparatus; and a second bar, which was made to slide along or across the fixed bar in every direction, represented part of the *moveable plane* of the apparatus. The moveable bar was then attached to the fixed ones by means of two cranks, and as, during the motion of the bar, the extremities of these two cranks must necessarily describe *circular lines*, the action of the first division was distinctly exhibited, as represented in the diagram, viz. two poles on one plane, and two circular lines on the other. The four points of action exhibited by the fixed and moveable extremities of the two cranks formed a trapezium.

A chalk point was then attached to the moveable bar, and as the lecturer gradually moved it round, it described on the surface of the drawing board a regular curve, of which the following figure will convey a tolerably correct idea:—



By a little attention, any person may in a short time, comparatively speaking, have a comprehensive idea of the general character of the curves in each division, or know to which division a particular curve belongs. For example, perhaps every person in this place will be able to recollect the trapezium formed by the cranks and the distance of the poles, in connection with the figure which is now described: these proportions are as necessary in generating this figure, as a centre is to the describing of a circle with a pair of compasses.

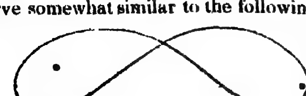
It is considered that a familiar acquaintance with the curves in this system will enable a person to judge correctly of the truth or inaccuracy of any line, for it is only by

comparison that we can form a correct judgment; and for the purposes of design it affords an infinite variety of the finest forms for patterns, mouldings, ornaments, &c. which may be enlarged, diminished, or reproduced of the same size at pleasure.

For producing gradations in the construction of *solids*, this division admits of great variety. It is also thought that it will produce the projections of the intersections of *cylinders*. The *parallel motion* in the steam-engine is a combination of the principles of this division; but it would be too long a digression to enter particularly into an explanation of that motion at present, as I consider it better to give a general explanation of the whole system than a particular explanation of a part.

In *excentric turning*, but more particularly those methods which have been employed to produce specimens for bank notes, the object has been to accomplish something the most difficult to imitate. My object, however, has been totally different. What I have produced, I wished to know how I could reproduce with facility, either upon the same, or a different scale. I think many of the specimens of bank notes, if adopted, would never be correctly imitated; but a correct imitation is not necessary to deceive those who seldom see an original; and the more confused the original appears, the more easily they are deceived with its representation. My opinion is that the bank note should be simple, yet so perfect, that only by the means used it could be made perfect. At the same time, these means ought to be such as not to be obtained at *a small cost*, or to occupy *a small space*. If for instance, the motion of an apparatus for producing a bank note was so extended as to require a room fifty or a hundred feet long, such an instrument, however simple in its construction, could not be easily concealed, and if made mathematically correct, must be so expensive as to deter any one from attempting to imitate it. And this perhaps might be accomplished on the principles of this division.

Mr. Jopling then adjusted the bars by means of a single crank, so as to produce the action of the second division of the system, viz. two points, or poles, upon one plane and a right line and a circle upon the other. The motion of the chalk generated by this combination of the primary principles produced upon the drawing board a curve somewhat similar to the following:—



This division has three points of action, and in one of its modifications gives motion to the connecting rod in the steam engine. It also shews the gradual connection between the *Ellipse* and many other curves, and is the connecting link between the first and third divisions.

The third division, consisting of two poles on one plane, and two right lines on the other, has two points of action. By this the *Ellipses* and the *Cardioides* are described. The *Cardioid* was first treated of by Carre a hundred and twenty years ago. By this division the projections of the sphere and the perspective of circles may be drawn to any angle on the plane of description.

Mr. Jopling then proceeded to shew how the *Ionic volute* might be formed of *cardioides*, and having adjusted the fixed and moveable bars he described the volute on the drawing board, by changing the adjustment at each revolution. In the Ionic volute formed by this division, the bed of the abacus is a tangent to the finish of the volute. The method said to have been used by Vitruvius has this property.

The fourth division has but one point of action. This is evidently nothing more than common *turning*; but the facility with which a number of *concentric circles* may be described, and these to the smallest dimensions, renders this operation frequently useful. Parts of a circle are frequently required, and parts of many other curves will be often found necessary.

There are two points of action in the fifth division. The curves it describes are the *conchoid*, invented by Nichomedes two thousand years ago; the *cissoid*, invented by Diocles fourteen hundred years ago, and a great variety of other curves, amongst which it is thought the *parabola* and *hyperbola* will be found. Mr. Jopling attempted to describe the *conchoid* upon the drawing board, but his endeavours were frustrated by the bad quality of the chalk, which had occasioned considerable difficulty in tracing the preceding curves. He succeeded in drawing enough of the figures to convince the audience that it would have been correctly described if the fragile substance of the tracer had not failed, and proceeded to observe that a gradual connection might be traced between all the curves in this, as well as in every other division. In performing the operations of the five divisions he had now explained, he reminded his hearers that they had all been accomplished with straight pieces of wood, so that these divisions were unlimited in their application.

Mr. Jopling shewed the action of the

sixth and seventh divisions without attempting to draw the curves. The sixth division, depending upon the motion of a circle on a plane, is considered equivalent to three points of action, and the curves it describes are the *cycloids*, the *evolutes*, and many others connected with them. The operation of the seventh division is considered equivalent to four points of action, and is produced by the motion of one circle round another. The *epicycloids* are the curves described by it. Swardi's, or the *geometric pen*, is a combination of this division.

The object I have in view, continued Mr. Jopling, has been principally to find out such methods of producing varying curves as would be easily applied to works of any dimensions. But in completing the system, I have been under the necessity of including the *cycloids*, *epicycloids*, &c. which are not easily applicable to works of great magnitude. Thus if in giving motion to a plane, a wheel be required, it must be evident that one of great diameter could not be used. Again, to produce a great variety, with respect to *magnitude* only, as great a variety in the sizes of the wheels will be necessary. Hence it is almost impossible to produce minute gradations in magnitude by the two last divisions. If however the describing point be attached to the motion of a pentagraph, this difficulty may in some measure be obviated, as a particular line may be thus enlarged or diminished with greater accuracy than could be done by regulating the pentagraph by the hand.

The classification of the modes of producing peculiar motions with the terms for each case in each division, together with a description of the imaginary lines which may be supposed to divide the *tracer* plane into different fields—the kinds of lines generated in the several cases, whether they are with or without change either in direction or curvature, whether finite or infinite, equal or unequal, right or oblique, nodated, cuspidated or oblate, and with or without contrary flexure—the several cases of harmony and of gradual connection, together with the combinations and applications of the principles—would require many evenings thoroughly to explain; yet when explained, all these may be readily under-

... principles of the system I consider to be perfect, and that a perfect knowledge of them must of necessity suggest various applications of them to the thinking mind.

I will now, Gentlemen, shew you with what facility the apparatus itself will describe a few lines; but before doing so, I will just state that by these two pivots and these two cranks, I can connect the two planes together so as to describe lines in the first five divisions.

Mr. Jopling accordingly drew, in a few minutes, a considerable number of curves of different kinds with the greatest facility, and distributed them for the inspection of the audience. After they had been handed round and examined, an immense variety of diagrams hitherto concealed from the view of the Members were uncovered. The greater part of these figures were coloured, and the beauty and elegance of their appearance could only be compared to the exquisitely varied forms produced by the Kaleidoscope. Patterns and ornaments of every description, applicable either to works of fancy, or to the more important purposes of civil and naval Architecture were included in the number, and the members expressed their surprise and gratification by repeated plaudits.

The lecturer then observed, that as his hearers could now form some idea of the effects of his invention, they would be enabled to judge of the correctness of the following testimonial in favor of the utility of the apparatus.

"We, the undersigned, have seen Mr. Joseph Jopling's newly invented apparatus for the organical description of curved lines, and have also seen its mode of operation, and have inspected a great variety of curves which have been described by means of it. We have no hesitation in saying, that we regard this apparatus as most simple and ingenious, capable of producing, with the utmost facility, an indefinite variety of curves, comprehending those which have been the subject of mathematical research, and numerous others, which cannot fail to be of great utility in *naval architecture*, in the ornamental departments of *civil architecture*, and in the formation of patterns in the imaginative regions of the arts. To mathematicians, the use of this apparatus will suggest a variety of inquiries in reference to new and curious curves, whose properties have not, as yet, been investigated; while to architects, shipwrights, engravers, and many others, it will be found subservient to the most fertile and interesting applications.

(Signed)

Olinthus Gregory, LL. D. Professor of Mathematics in the Royal Military Academy.

S. H. Christie, M. A. of the Royal Military Academy.

Arthur Aikin, Secretary to the Society of Arts, &c.

Thomas Tredgold, Civil Engineer.

Peter Barlow, F. R. S.

Mr. Jopling concluded by expressing his best thanks to Dr. Birkbeck for suggesting the idea for giving this lecture, and to the members in general for the great attention with which they had listened to his explanation.

At the conclusion of Mr. Lewthwaite's lecture on Wednesday evening last Dr. Birkbeck informed the members that the Drawing School would be opened for the first class on the following evening, Thursday; and for the second class on Tuesday evening next.——Dr. Birkbeck also announced, that the Sixth Quarterly General Meeting of the members would take place on Wednesday next, at eight o'clock in the evening, agreeable to the rules. It would be recollected that in their last report, the committee intimated that the next General Meeting would, in all probability, be held at the new lecture room. The building was now in such a state of forwardness, that it was possible to prepare it for that purpose, but to accomplish this, its final completion must necessarily be delayed; and as the committee had been informed that one ILLUSTRIOUS INDIVIDUAL, and several Noblemen and Members of Parliament intended to be present at the opening of the lecture room, which would not be in their power if it was delayed beyond the latter end of next month, it had therefore been determined to hold the next Quarterly Meeting at the Chapel in Monkwell-street.

LECTURES FOR NEXT WEEK.

On Wednesday next, June 1, there will be no lecture, in consequence of the Quarterly General Meeting.

Friday, June 3, Mr. Wallis's second lecture on Astronomy.

BRISTOL MECHANICS' INSTITUTION.

A numerous Meeting was held on Tuesday the 10th instant, at the Lancasterian school room, Red Cross street, Bristol, to take into consideration the propriety of forming a Mechanics' Institution in that City, upon the plan of similar Institutions in London, Glasgow, &c. The Meeting was attended by many highly respectable individuals who generally take the lead in works of benevolence and philanthropy.

C. Pinney, Esq. being called to the chair, addressed the Meeting in an eloquent and impressive speech, to which our limits will not allow us to do justice. We cannot, he observed, but dwell with delight on the auspicious prospects which appear to have been for a considerable time opening on every side, through the instrumentality of the numerous Societies around us; and it is our object this evening to consider of the formation of an Institution likely to be inferior to none in its beneficial tendency.—Other places have preceded us in this important work: London, Glasgow, and Liverpool, our rivals in commerce, have their Mechanics' Institutes; nay, they have even passed over the channel to the Sister Isle, leaving our city behind them in their progress; but if I may judge by the interest excited on this subject in the numerous meeting before me, this stigma will not long remain, but we shall also soon possess a School of Science for the benefit of the operative classes of the community, created by their own exertions, in which they will have an independent interest, and where, by their united efforts, a Library for reference and circulation, a Museum, and regular courses of Lectures will be established; this will be an efficient means of advancing their native talents, improving the arts of life, and be an innocent source of delightful recreation.

Mr. Pinney proceeded to take a comprehensive review of the important results which might be anticipated from the general establishment of Mechanics' Institutions, and pointed out numerous instances in which the most trivial circumstances had led to the most important discoveries. He also adduced several striking examples of the developement of talent in men from the operative classes of society.

Extensive instructions in our populous and manufacturing districts will have a desirable and beneficial effect on the coming age, for if our wealth as a nation should increase to the utmost extent that avarice itself could desire, yet unless morality and virtue are sufficiently prevalent to check the torrent of vice, the stability and permanency of our prosperity must be weakened. An ignorant man knows not how to unite the correction and improvement of his mind with the use and employment of it; his capacity of enjoyment and usefulness is proportioned to his knowledge. Diminish the number of his ideas, and you so far carry him back towards the state of inert matter from which he was formed—enlarge his intellectual stores, and you proportionably elevate him from the brutes, and give him an alliance with superior nature,—illumine his paths with the rays of truth, and you guide him to happiness; surround him with the mists of error, and you delude his imagination; mislead his passions, and you involve him in endless perplexity.

The worthy Chairman illustrated his subject by a variety of other arguments, and con-

cluded his powerful appeal amidst the plaudits of the audience.

Various Resolutions, relating to the formation of the Institution, were then successively proposed and seconded by R. Bright, Esq. Joseph Reynolds, Esq. the Reverend Dr. Carpenter, &c. The latter Gentleman delivered an admirable speech on the important object for which the Meeting was assembled, and concluded by alluding to the fact that the operative mechanics of Birmingham were allowed to be the best informed of any in the kingdom—their present peaceable conduct forming a contrast to what it exhibited some years since, during those disgraceful riots which he would avoid dwelling upon; and what was this to be ascribed to, but to the establishment of a cheap Artizan's Library, which commenced about 1795, to which each individual paid 1d. per week, or at most 2s. per quarter? At present this library consisted of 2000 vols., which were in great request by the Subscribers. Exeter also possessed a simiiar treasure; and why not Bristol? No doubt it shortly would: great good was obtained from small means; and he anticipated from that evening's proceedings that Bristol would soon take a foremost rank among the great cities of the empire: London, Glasgow, Liverpool, Manchester, &c. had their Institutions, and so now would Bristol. The Dr. again noticed the benefit of having a place to which ingenious mechanics might bring their models and designs, and instanced that the celebrated Mr. Watt, whose memory was dear to science, did not make his discovery at once; long and close attention was generally necessary to the discovery of subjects of great usefulness, and this attention would always be aided by philosophical apparatus. The Dr. expressed his cordial approbation of the exclusion of debatable points on religion and politics, and impressed on the meeting the close connection which existed between science, virtue, true religion, and happiness.

Several other Gentlemen addressed the Meeting, the proceedings of which were conducted with the greatest regularity and unanimity; and after its adjournment, numbers of individuals came forward to enrol their names as subscribers to the Institution.

LONDON FRIENDLY INSTITUTION OF MECHANICS, ARTISANS, AND OTHERS, 126, NEWGATE STREET.

As the principal purpose of our labours is the diffusion of any information which may conduce either to the scientific instruction or the domestic comforts of the operative classes of society, we have great pleasure in extending a knowledge of the existence of an institution which appears well calculated to promote the latter object. We have perused the Rules and Regulations of the London Friendly Institution of Mechanics, which are drawn up with considerable ability, and from the well known talents of the actuaries, under whose superintendance the various tables of payment have been constructed (Mr. Morgan, of the Equitable Society, and Mr. Frend, of the Rock Assurance Office) we are satisfied that the calculations are made upon principles which will insure the stability of the institution, and prevent the mischiefs which have in some instances arisen from the want of sufficient caution in this important particular. The high respectability of the trustees, the whole of whom are distinguished by their exertions on behalf of the mechanics, affords another powerful guarantee of the excellence of the society to which they have afforded their patronage and assistance.

The first General Meeting of the members of this institution, was held on Monday evening the 2nd instant, at Dolly's Tavern, Newgate-street, Dr. Birkbeck (one of the trustees, and President of the London Mechanics' Institution,) in the Chair.

Among the gentlemen present, we noticed J. Martineau, Esq. W. Brennand, Esq. G. Collyer, Esq. J. Bainbridge, Esq. J. Lowdell, Esq. A. M'Donnell, Esq. J. Waddy, Esq. and the founders of the institution. The numerous attendance of the mechanics and artisans of the metropolis, to promote whose best interests this institution has been founded, afforded reasonable ground for anticipating an early application of the benefits it is expected to confer.

The object of the institution is to enable the labouring classes of the metropolis to provide themselves by convenient and easy payments, with weekly allowances, medical attendance, and medicine in the hour of sickness, sums of money at death, annuities, endowments, &c. for which purposes an office is opened at the northern end of Newgate-street.

The secretary read a report to the meeting, describing the progress of the institution, from which it appeared to be the intention of its founders and conductors, to

assimilate the establishment to the existing Life Assurance Offices, transacting the business upon similar principles; modified, however, in their operation, so as to attain the objects desired at the least possible sacrifice on the part of the members seeking the benefits promised by the institution.

This report, as well as that of the auditors, detailing the receipts and disbursements up to March last, were received with considerable approbation by the meeting. Among other circumstances of a pleasing nature in these reports, we observed that not a single claim had yet been made on either of the funds, although there had been free members for three months.

J. Martineau, Esq. (one of the trustees) expressed his satisfaction at the plan of the institution, and highly eulogised the respectable and honourable manner in which it had been conducted. From his situation in life, he was well convinced that an institution of this nature would prove highly beneficial to the mechanics and artisans in and about the metropolis, and the members might rely on his hearty co-operation in all means for the promotion of its views.

After the directors and auditors for the ensuing year had been elected, the thanks of the meeting were voted to the medical attendants for their attention to the interests of the institution.

The medical attendants in returning thanks promised the same attention to the members when they should need their aid, as they had given to the interests of the institution on the admission of members.

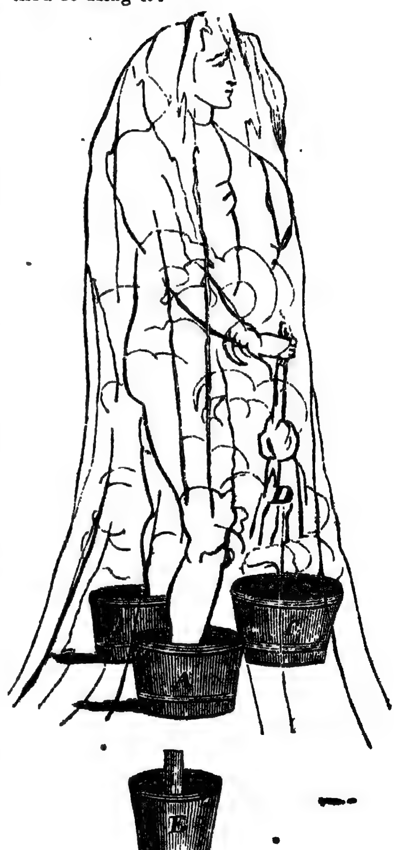
The thanks of the meeting having been voted to its respected Chairman for his uniform urbanity and kindness, his able conduct in the chair, and to the trustees for their services to the institution.

Dr. Birkbeck, in returning thanks, congratulated the meeting on the establishment of an institution which he had always thought would be conducive to the comforts of the operative classes of the metropolis.—After briefly expressing his conviction of the merits of this establishment, which he could only compare with the Equitable Life Assurance, the learned chairman promised to exert himself to the utmost of his power, in furthering the objects of the institution.

The meeting separated highly pleased with the promising appearance of this infant establishment.

ADMIRAL BROOKING'S PORTABLE STEAM OR VAPOUR BATH.

The inventor of this simple and efficacious apparatus, in the pamphlet from which we have extracted a description of it, introduces the subject of Steam Bathing by a variety of appropriate observations on its great utility in cases of rheumatism or severe cold; together with some remarks on the beneficial effects derived, even by persons in good health, from the promotion of profuse perspiration. The following sketch will sufficiently explain the construction of the Bath, and the method of using it:—



A, B, tubs with lukewarm water to stand in. C, a tub into which boiling water must be poured after the Bath bag is put on, and out of which a towel, D, with a

wooden handle must be occasionally drawn up to cause steam. E, a copper case to hold a red-hot heater, like that of an urn, which may be used or not as may be found necessary.

"To use this simple bath," says the inventor, "it is necessary to have a bag, made of such materials as will most effectually prevent the escape of steam; the thickest and closest woollen will probably be the best, but still better an oil-skin lined with flannel. The dimensions should be about a foot higher than the person; and broad enough to allow room for the arms to move, for the purpose of cleansing the back, and rubbing every part of the body well, while in a state of perspiration. It should be open at the bottom, and opposite to the situation of the face; and be sufficiently large to allow its slipping down over the shoulders after the bath, but this last opening should overlap in order to keep in the steam, and prevent the air from rushing in, except when there is occasion to open it for the purpose that will be mentioned. A wooden oval tub will also be necessary, large enough to hold two or three gallons of water; also a cloth or towel fastened to a piece of stick about a foot long, by which it is to be occasionally drawn up out of the water to increase the steam.

"Having a good fire, with the Bath bag, towels, a warm woollen dress to put on after the bath, all well dried or aired, and a large tea or other kettle of water boiling, strip and put on the bag, having the tub with the steam towel between your feet, then lift up the bag and pour in the boiling water, allowing as little as you can of the steam to escape, and taking care that the bottom of the bag is close down to the floor to prevent the cold air getting in, draw up the steam-cloth by the wooden handle, and in the course of a minute or two, you will find yourself enveloped in steam; and if you have carefully shut out the cold air, you will probably be in a profuse perspiration, which by rubbing every part of the body, will no doubt with the steam free it from any impurity, from which the most healthy, delicate, and cleanly, are not entirely free. I should have mentioned a large sponge, placed within reach, as a necessary article for the purpose of washing off. Two small tubs, with warm water, just big enough to hold each a foot, will also be of use; to be placed on each side the larger tub, and will add in some measure to the heat and steam. As the bather will most probably continue to perspire for one, two, or three half hours, or as long as he chooses to encourage it, he should occasionally rub himself to disperse the moisture, and to prevent any ill effect from the body drying partially. At least this has been the practice which the contriver has found to answer, without once catching cold; but on the contrary, experiencing the most beneficial effects. If adopted as a cure for a cold, it will probably be best to use it just before going to bed, and to wear flannel till the perspiration has ceased.

"To give the name of vapour bath, to a thing that at the most can be fitted up for a less sum than would be demanded for half a dozen bathings, in any vapour bath in England, may, by those who value things in proportion as they are complex and expensive, be thought to assume too much. Notwithstanding its simplicity, it is probably as efficacious as any; being, with a proper attention to the directions, capable of bringing on a profuse perspiration in a minute or two, to any degree, and for any reasonable time.

"In order to judge of the degree, I have sometimes had the flannel dress that I put on after bathing, and change on going into bed, rolled up and in the morning weighed, then dried and again weighed, when it has been found to have lost in weight from ten to twelve ounces; which, added to what must have escaped from it and me, during perhaps the three quarters of an hour that I was in a profuse perspiration, from the time of throwing off the bag to going to bed, must have amounted to more than I will venture to say, but which may be easily conceived.

"To increase the steam in cold water, I sometimes use a hot iron, like that of a tea-urn, inclosed in a copper case, standing in the boiling water—occasionally letting fall a few drops from the towel upon it. By this means the steam is increased in quantity or heat to the utmost that can be desired."

The writer then adduces several instances in which vapour bathing, by means of his economical apparatus, had been resorted to with great success, and concludes with the following testimonial of its merits:—

Plymouth, July 8, 1824.

DEAR SIR—In reply to your note I beg to say I have much pleasure in bearing testimony to the beneficial operation of the vapour baths, on the plan recommended in your observations.

It has been employed by me in several instances, and attended with those results which vapour bathing in general is calculated to produce, possessing equal, if not

superior, advantages over the means which are usually resorted to.

Its claims to recommendation will be found in the simplicity, portability, and ready application of it; and, above all, the trifling cost at which it may be procured.

Believe me Dear Sir,

Very truly yours,

WM. M. TRACEY, Surgeon.

To Rear-Admiral Brooking.

ROBERTS'S HOOD AND MOUTH PIECE.

To the Editor of the Mechanics' Register.

Sir—From the numerous fatal accidents that are continually occurring to persons descending into impure wells, by what is termed the choke damp in coal mines, and other similar causes, I beg to suggest, through your valuable miscellany, whether Roberts's Hood and Mouth Piece might not be usefully and successfully employed for the preservation of lives on such occasions.—Yours, &c. S. HOLLANDS.

Southville.

*** In reply to the suggestion of Mr. Hollands, we beg to state that the presence of a portion of *atmospheric air* is always essential to the utility of Mr. Roberts's admirable invention. By the experiments already performed in an atmosphere charged with *sulphurous acid gas* and other noxious vapours, it has been satisfactorily demonstrated that these vapours are intercepted by the water of the sponge at the extremity of the apparatus, while a free passage is allowed for respirable air, so that the wearer of the hood is enabled to breathe freely for a considerable time in an atmosphere which would be almost instantly fatal without its assistance. But in these experiments, *oxygen* has always been present; for if this had not been the case, Roberts would have been as incapable of breathing with the apparatus as without it. From these observations it follows, that if a quantity of *carbonic acid gas* or *carburetted hydrogen gas* covers the bottom of a well, without any admixture of *atmospheric air*, the hood would fail in protecting the wearer from the fatal effects of these gases.—ED.

To the Editor of the Mechanics' Register.

Sir—I have delayed the following inquiry in the hope that some of the succeeding articles to that herein referred to, would have rendered this unnecessary; but the subject being now abandoned, I am induced to request information from those competent to afford it.

In the article detailing the experiment made with Roberts's Hood and Mouth Piece, page 362, of the REGISTER, we are informed that the experimentalist during his confinement, frequently ascended a ladder, and that the contents of one of the bottles filled with vapour for chemical examination, was procured near the ceiling of the room. Now it does not appear from the engraving, with which your 24th Number is embellished, that the tube leading from the hood is capable of being lengthened at pleasure, neither do you lead us to believe that any such thing is contemplated. How then, I beg to be informed, did Roberts contrive to respire when upon the ladder, or when filling the bottle with the air near the ceiling? For supposing the room to be of the moderate height of ten feet, the funnel attached to the mouth piece must have been four or five feet from the floor, considerably higher than the heads of those persons, who you in the same article inform us, " entered on their hands and knees, but after remaining only a few moments, were driven out apparently half suffocated."

With an assurance that I have herein been actuated only by a desire to afford an opportunity of amending a part of a narrative that at present appears a little defective,

I beg to subscribe myself, Sir,

Your sincere well wisher,

Vauxhall, May 9, 1825. S.

*** We have great satisfaction in obviating the well expressed doubts of this correspondent, by reminding him that the analysis of the three portions of air taken in the chamber in which Roberts was confined, (which was 16 feet high) exhibited a quantity of *oxygen gas* sufficient for the support of respiration; and that even the portion from the highest part of the room, although much more charged with the noxious vapours from the burning matter below, possessed 18 per cent. of oxygen. That Roberts breathed comfortably there would therefore be expected, so far as *atmospheric air* is concerned, and must be understood to establish the complete *filtering*, or *purifying power* of the medium through which the vitiated air of the room was compelled to pass before it entered his lungs. By this

power, consequently, the necessity for lengthening the pipe connected with the mouth piece was superseded; and it appears to be fully established that the only condition indispensible to the person provided with such power, in whatever place he may be situated, is the presence of that quantity of *atmospheric air* or *oxygen*, without which, life, under all circumstances, must soon be extinguished.—ED.

QUERIES.

No. 21.—VAPOUR BATHING.

Sir—Observing in the REGISTER of the 26th of March last, a recommendation of vapour bathing, permit me to request that yourself or readers will furnish me through the medium of your pages, with a description of the most convenient apparatus for domestic use. Expense will not be a particular consideration, if productive of much real advantage. I have frequently seen advertisements from makers in different parts of the metropolis; but not having an opportunity to inspect their articles, I am unable to judge their comparative merits. Wishing you every success in the propagation of scientific knowledge and general information, which your exertions in aid of their diffusion merit,

I am, yours respectfully,
MECHANICUS.

No. 22.

What is the cheapest preparation for putting on canvass to hinder steampassing through it? The canvass so prepared is for a vapour bath. A SUBSCRIBER.

*** The article on vapour bathing inserted in our present Number, will perhaps furnish a satisfactory reply to the two preceding queries.—ED.

No. 23.—CAPILLARY TUBES.

1.—If a capillary tube, or a hair-like tube of glass be dipped at one end into water, the water will rise within the tube to a height which will be reciprocally proportional to its diameter, and both in its ascent and after it has arrived to its utmost height, its surface will be concave. What is the cause of its concavity?

2.—If a small column of mercury be similarly suspended, or even as supported in the barometer, the surface of the column will be convex. What is the cause of its convexity?

117, London Road. THOS. TAYLOR.

No. 24.

Sir—As a constant reader of your valuable work, I hope I shall not be intruding if I request the insertion of the following query, viz.:—What is the best and cheapest way to dye oxen's hides red, as the Russian leather?

An answer will greatly oblige your's, &c.
A. PRETTO.

No. 25.

To make the black sold under the name of the liquid black cloth renovator.

INQUISITUS.

ANSWERS TO QUERIES.

QUERY, No. 9, page 30.
COLOUR OF LOBSTERS AND CRABS.

Woolwich, May 16, 1825.

SIR—If the following experiments on the colouring matter of the shell of the crab will in any way solve the difficulty under which your correspondent W. H. seems to labour (page 30, vol 2, of your very useful Register) I shall feel happy in having an opportunity of forwarding the information which he requires, and for which I am indebted to the *Journal de Pharmacie*, tom. 6, page 175 to 176.

"It is well known that when a crab is boiled, its shell assumes a fine red colour, the nature and origin of which have hitherto been unknown; at the desire of M. Latrille, a series of experiments upon it was undertaken by M. J. L. Lassaigne.

"The shells of the crab, having been carefully freed from all fleshy matter, was plunged into pure alcohol, of the temperature of 59° Fahrenheit, they assumed a scarlet colour, which was instantly communicated to the alcohol. The alcoholic solution of the colouring matter was then decanted, and new doses of alcohol added till it ceased to be coloured; the shells were thus exhausted of their property of becoming red in boiling water.

"From the spontaneous evaporation of the different alcoholic solutions, a red, and apparently fatty matter was obtained; this matter has no smell or sensible taste, is insoluble in cold or boiling water, but soluble in sulphuric ether and pure alcohol. This solution is of a scarlet colour; it is not disturbed by the addition of distilled water, which shews that it is not of a fatty nature. Its natural colour is not changed

by potash, soda, or ammonia; the mineral acids have no action upon it when diluted with water; but when concentrated they destroy it, by changing it to a dirty yellow. The salts of lead, tin, iron, and copper, do not precipitate this colouring matter from an alcoholic solution diluted with water.

" M. Lassaigne also examined the membrane, which in young crabs adheres strongly to the shell, but which may be easily separated from it in large crabs. It is extremely fine, and of a violet colour by reflected light, and a purple violet by transmitted light. When put into water it does not lose its colour, but in cold alcohol it gives out a great quantity of red colouring matter, similar to that which is extracted from the shell, though treated successively with several doses of alcohol. This membrane retains a little of its red violet colour, which cannot be taken away from it by other solvents, without destroying the membrane itself; the colouring matter has the same properties as that of the shell.

" M. Lassaigne has found the same principle in lobsters, and other animals of the same order; and he concludes :—

First—That crabs, &c. contain a red colouring principle, which may be extracted by means of cold alcohol.

Second—That this colour is not formed by the action of heat; but that it is developed or distributed in the shell by the impulsion of that fluid.

Third—That there exists a highly coloured membrane, which appears to be the source of the colouring matter in that class of animals, and

Fourth—That this colouring matter differs in its chemical properties from others obtained from the mineral and vegetable kingdoms."

I am, Sir, your obedient servant,
J. MARSH.

QUERY, No. 1, page 16.

SIR—In reply to the query of Electricus, page 16, the following method will answer his purpose. Anoint the broken edges with the white of an egg, over which shake a little finely powdered unslaked lime, placing them together immediately. This will unite them so firmly, that no power will again separate them.

Westminster. A. Z.

QUERY, No. 13, page 31.

SIR—In answer to the question of your correspondent Eff Ess, No. 13, in your interesting miscellany of May 14, I beg to state, that the tradesman who has just commenced business with only four weights can weigh any number of pounds from one to forty, by having a 1lb. 3lb. 9lb. and 27lb. weight. The above results are obtained by dividing the number 40 according to the *ternary scale*, as exhibited by Mr. Dotchen in his able lectures on arithmetic at the London Mechanics' Institution.

```
3 | 40
  |-----
3 | 13. 1
  |-----
3 |  4. 1
    -----
     1. 1
```

The truth of the above may be fully proved by such examples as under; for instance, let it be required to weigh 2, 5, 8, 19, 29, and 34 pounds:—they will be accurately weighed by arranging the weights in the following manner:—

2lbs.	5lbs.	8lbs.	19lbs.	29lbs.	34lbs.
3 1	9	9 1	27 9	27 1	27 3
			1		9
					1

Your sincere well-wisher,
Oxford-street. T. S.

P. S. The surprise of the tradesman's customers will perhaps be increased when they are informed, that by *one* additional weight he could weigh from one pound to more than three times the amount mentioned by your correspondent Eff Ess.

*** We have received answers to the same query from J. Clarke, Experimentas, A. Z. and others, the whole of which are correct as to the result. Some of these answers include a scale of the whole series from 1lb. to 40lbs. the insertion of which we think unnecessary, as the preceding examples are sufficient to prove the practicability of the rest.—ED.

QUERY, No. 15, Page 31.
POLISHING MARBLE, &c.

SIR—In answer to a part of Query 15, of your highly valuable and justly appreciated Register, I beg leave to submit the following, if you think it worthy of insertion.

The following is the process of polishing the most common sorts of marble. If the piece to be polished is a plane surface, it is first rubbed by means of another piece of marble, or hard stone, with the intervention of sand (of two sorts) and water; first with the finest river or drift sand, and then with common house or white sand, which latter leaves the surface sufficiently smooth for its subjection to the process of gritting. Three sorts of grit stone are employed: first, Newcastle grit; second, a fine grit

brought from the neighbourhood of Leeds; and, lastly, a still finer, called snake grit, procured at Ayr, in Scotland. These are rubbed successively on the surface with water alone; by these means the surface is gradually reduced to that closeness of texture fitting it for the process of glazing, which is performed by means of a wooden block having a piece of thick woollen stuff lined tightly on it; the interstices of the fibres of this are filled with prepared putty powder, or per-oxide of tin, and moistened with water; this being laid on the marble and loaded, it is drawn up and down the marble by means of a handle, being occasionally wetted, until the desired gloss is produced.

The polishin f mouldings and enrichments is done with the same materials, but with rubbers varied in shape according to that of the moulding or enrichment. The block is not used in this case; in its stead a piece of linen cloth, folded to make a handful; this alsocontains the putty and water.

With regard to the size of the sand rubbers employed to polish a slab of large dimensions, they should never exceed two-thirds of its length, nor one-third of its width; but if the piece of marble is small, it may be sanded itself on a larger piece of stone. The grit rubbers are never larger than that they may be easily held in one hand; the largest block is about fourteen inches in length and four inches and a half in width.—I am, Sir, your's respectfully,

H——Y P——E.

First rub the flint or marble down to a fine face with coarse, and then with fine sand; then rub it with first grit till you have got all the sand marks out; then rub it with second grit till you have got all the scratches out from the first grit; then rub it with third grit (or water of Ayr) till it comes to a low polish; then use powder of putty, and rub it with a wet piece of woollen cloth till it is brought to a fine polish. The first, second, and third grit, and also the putty, may be had at the sign of the Gridiron, High-street, Bloomsbury.

A. Z.

QUERY, No. 17, Page 31.

Prepared ox gall for painting in water colours is sold by Roberson, artists' colourman, 54, Long-acre. He has received a premium from the Society of Arts for the discovery, therefore the method of preparing it is described in the Society's Transactions.

QUERY, No. 20, Page 31.

If wax, pitch, &c. sticks to cloth, wet the opposite side of the cloth with cold water, and it will pull off without injuring the nap.

J. WEBB, Engraver.

QUERY, No. 18, Page 31.

SIR—You will oblige me by assuring your correspondent, G. T. P., that if he boils a few strips of isinglass in a quart of spring water, and passes his drawing through the same, when cool and spread out in a dish or other flat vessel, even should he pass a piece of Indian rubber over it, he will not be able to efface a shade from the finest stroke of the pencil.

Your's, &c.

OPIFICI AMICUS.

TO CORRESPONDENTS.

F. C. has sufficient cause for complaint; but he is not aware that he is visiting upon us the sins of predecessor. The communications of F. C. and several others, have never been in our possession, and we have experienced much inconvenience from this circumstance. If our correspondent will oblige us with a copy of his former letter, it shall receive every attention.

The Queries of C. T. S.,—W. H.—P. B. E.—and S. M. T. are intended for insertion.

Mr. DEWHURST's method of preparing a Hortus Siccus and Mr. BARRETT on the formation of Pearls will appear, if possible, in our next number.

We are happy to receive from our readers any suggestions for the improvement of our publication. Those of MECHANICUS will be attended to. His first hint coincides with our previous determination; and opportunities will occur for complying with his second intimation.

Mr. Barr's queries are under consideration. His solution to query 13 has been anticipated by several correspondents.

Several other communications are necessarily deferred for want of room; and in order to afford an opportunity for their insertion, as well as to lay before our readers a full account of the proceedings of the Quarterly General Meeting of the London Mechanics' Institution, with the Report of the Committee, we shall publish a Double Number next week.

ERRATUM.—In Mr. Wallis's reply to Asteroid, page 45, col. 2, line 22 from the bottom, for "600," read "30 times lighter than pure hydrogen gas."

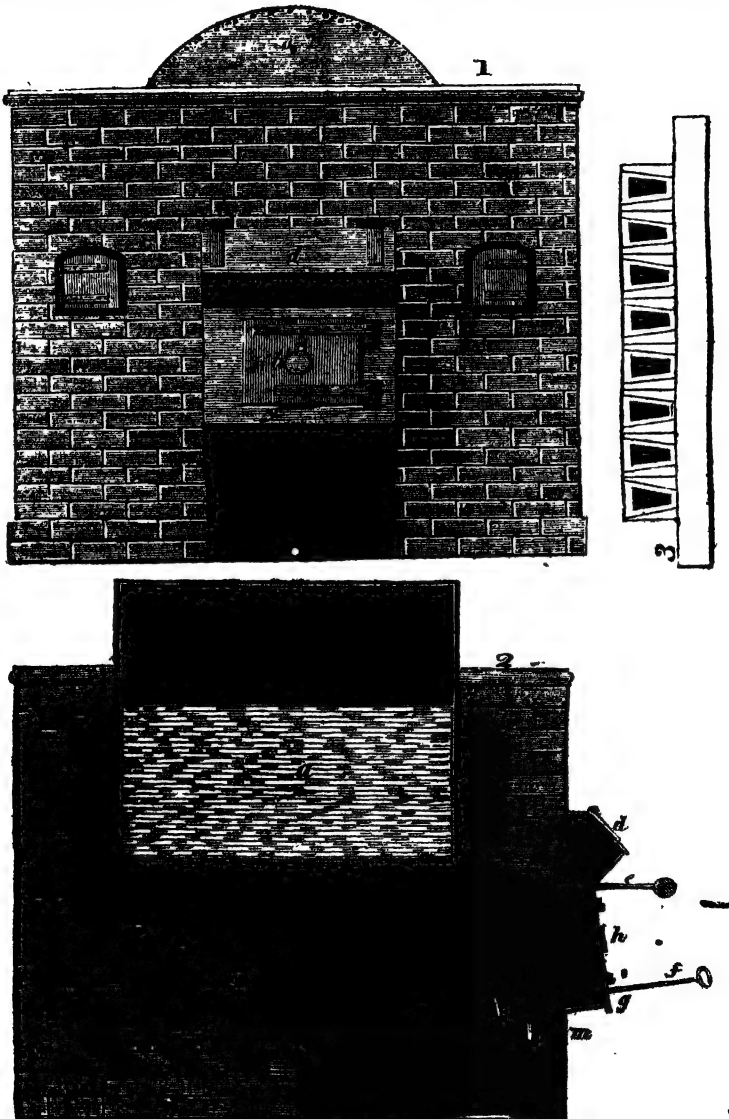
LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communications (post-paid) requested to be addressed.
Sold by SHERWOOD, JONES, & Co., Paternoster Row; and may be had of all Booksellers and Newsmen.
Also, Sold by A. & W. GALIGNANI, No. 18, Rue Vivienne, Paris; C. WILEY, New-York; CARFRAE, Rio Janiero.

THE LONDON

MECHANICS' REGISTER.

" Few things are impracticable in themselves; and it is for want of application, rather than of means, that men fail of success." De La Rochefoucault.

No. 33.] SATURDAY, JUNE 4, 1825. [Price 3d.



CHAPMAN's PLAN FOR CONSUMING THE SMOKE OF STEAM BOILERS, &c.

MR. CHAPMAN'S PLAN FOR CONSUMING THE SMOKE OF STEAM BOILERS, &c.

The excellent plan for obviating the serious inconvenience arising from the dense smoke from Steam Boiler Furnaces, &c. which we have this week the pleasure of laying before our readers, is the invention of Mr. G. CHAPMAN of Whitby, whose ingenuity was rewarded by the Large Silver Medal of the Society of Arts. The following is the inventor's description of his apparatus, extracted from the last Volume of the Society's Transactions :—

"It is well known to all that are conversant on the subject, that it is necessary to admit a proportion of pure atmospheric air, to unite with the smoke after it is generated in the furnace, in order to supply the oxygen gas, without which it will not inflame. It is likewise known that any air admitted into the body of the furnace, if it does not go through the burning fuel, has a great tendency to cool the bottom of the boiler, and retard the generation of steam. To obviate this, it is the general practice, in the construction of those furnaces which consume the smoke, to admit the air partly at the ash-pit, and partly up through the fire-bridge. I offer for the consideration of the Society an improved plan, which I have adopted, and which has answered beyond my utmost expectations. It is as follows:

"To heat the air before its admission into the furnace. This I do by casting the grate bars hollow from end to end, so that they form a series of parallel tubes, which open into two boxes, one placed in front, and the other behind the grate. In the front box, directly underneath the fire-door, I make a register to open and shut, to any extent, at pleasure. The other end I connect with the brick-work directly under the fire-bridge, which fire-bridge I make *double*, with a small interval between, say one inch; the interval to go across the furnace from side to side, and rather to incline forward, or towards the fire-door, so as to meet and reverberate the smoke on to the ignited fuel in the grate, which causes it to inflame and become a sheet of bright fire under the bottom of the boiler.

"From what I have said it will appear that if the front register is open, or partially so, there will be a great draught of air through it, along the interior of the grate bars, thence into the flue of the fire-bridge, and out of the orifice at top, which air will be heated in its passage through the bars, before it comes in contact with the smoke, when it will give out its oxygen, and cause it to inflame.

"Such was my view of this part of the subject in theory, and I have found it to succeed in practice, in a small engine of my own. But a further improvement was necessary to make it quite perfect. There are few people who are aware of the extent of the mischief arising from the old method of charging a grate by the front door. Now, in my engine, (which is only two-horse power), I calculated that every time the fire-door was opened to stir the fire and replenish the fuel, there could not be less than from forty-five to fifty cubic feet of cold atmospherical air admitted into the furnace, which so cooled the heated gases, &c. that, however complete the plan was in other respects, the smoke could not possibly inflame, from being so cooled, till a considerable time after the fire-door was shut.

"To obviate this I have adopted a cast-iron hopper above the fire-door, with a type at the bottom that has two pivots at one side and opens at the other; one pivot goes through the end of the hopper and has a counter lever to keep the type shut when a sufficient quantity of coal for a charge is on it. The top of the hopper is covered with a lid which I shut down during the time of firing, then, by lifting the lever which opens the type inside, the coals slide down on to the fore end of the grate bars, which is only the work of a moment. It is evident that no quantity of cold air can thus get into the furnace; in fact, it is not possible for any person that does not see the operation of firing to know when fresh fuel is added by looking at the top of the chimney. The smoke that issues is never more than a light grey, just perceptible, but in a general way is not seen at all.

"The coals last admitted, after lying a short time at the front of the more ignited fuel, become partially coked, and just before I admit a fresh supply, I push the last charge further along the grate, by a tool made for the purpose, which remains constantly in the furnace. It consists of a plate of iron about four inches broad; its length goes across the grate with a round

bar of iron rivetted into its centre, at right angles, to form a handle, which comes through a hole made in the bottom of the fire-door, and is long enough for a man to use with both hands, so that he can either push from, or pull towards him, to manage the fire within, without opening the fire-door, except when the grate wants cleaning, &c. &c. For better knowing when the fire wants stirring, or replenishing, I have a hole, about an inch in diameter, in the fire-door, to look through, covered by a piece of iron which hangs by a rivet above.

"After I have used the above instrument, I pull it up close to the fire-door, where it remains till it is again wanted; and the coals, when let into the fire, fall down beyond it.

"The above-written account constitutes the whole of my improvements as far as is required by the Society, but not the whole of the advantages gained by my invention. For instance, the durability of the grate-bars by the admission of air through them. I may add, that I examined my own yesterday, and I do not find them any worse, although they have been in use four months. In conclusion, I beg leave to refer you to the accompanying certificates by gentlemen who have had an opportunity of personally viewing my improvement, and who, I flatter myself, are all people of the first respectability.

"N. B. I am perfectly aware that there are many plans of feeding furnaces by means of hoppers, yet I trust you will find my plan somewhat different; it is at least to what have fallen under my notice."

References to the Engraving.

Fig. 1, An elevation.

Fig. 2, A section.

(The same letters refer to the same parts in both figures.)

a The boiler.

b The fire-place.

c The feeding-hopper, with its cover *d*, and its type, or turning bottom, with its lever and counterpoise *e*, by means of which the coals are delivered into the fire-place.

f A rake, by means of which the half-burnt coals are pushed forwards previously to letting in a fresh charge.

g A slit below the furnace-door, through which the shaft of the rake passes.

h An eye-hole in the furnace-door, through which the state of the fire is seen.

i i An air-tight box; into the back of which the bars open, and in front of which is a register for the admission of air.

k One of the hollow bars, the whole of which are shown in fig. 2, as they open into the box *i*, fig. 1.

l A flue in the fire-bridge, through which the air, having passed first into the box *i*, and thence through the hollow bars *k*, passes into the furnace and consumes the smoke.

Sneaton Castle, Whitby.

This is to certify that I have examined Mr. Geo. Chapman's invention for the consumption of smoke arising from furnaces of steam-engines, &c., and I find it answer every purpose preferable to any other that I have yet seen, and consider it worthy of the notice of the Society for the encouragement of Arts and Manufactures.

JAS. WILSON.

Having examined the apparatus invented by Mr. Geo. Chapman of this place, to prevent the emission of dense smoke from the furnace of his steam-engine, and having seen it brought to the test of experiment, I am fully satisfied as to its success; and have no doubt, that were the same apparatus generally adopted, the smoke from such furnaces would no longer be a nuisance to the vicinity.

GEO. YOUNG, A. M.
Secretary to the Whitby Literary and Philosophical Society.

I beg leave to state, that I have visited Mr. Geo. Chapman's foundry, for the purpose of witnessing his improved method of consuming the smoke which is generated in furnaces. Mr. Chapman's plan, as he observed, seems to consist, principally, in admitting the atmospheric air necessary for combustion along the heated bars of the fire grate, which are cast hollow for that purpose. The air being heated in its passage, more readily gives out its oxygen, by which the generation of smoke is nearly prevented, and the process of combustion more accurately performed.

On the application of fresh fuel, the smoke which ascended from the chimney assumed the appearance of a light grey vapour, and in a few seconds became nearly invisible.

The superiority of Mr. Chapman's method was further evinced by opening the door of the furnace and allowing a quantity of cold atmospheric air to enter in the usual way; when this was done, the smoke rolled out of the chimney in black dense clouds, which effect ceased almost immediately on closing the door.

Whitby. RICH. MOORSOM, JUN.

SOCIETY FOR SUPERSEDING THE NECESSITY OF EMPLOYING CLIMBING-BOYS.

On Friday in last week, after an interval of six years, a public meeting of the friends and supporters of this society was held at the City of London Tavern, for the purpose of taking into consideration the best means of abolishing the practice of employing boys to sweep chimneys. More than 300 of the most respectable females, amongst whom were many of the Society of Friends, attended the meeting, and took a great interest in the proceedings.

The Lord Mayor took the chair. He said, it was useless to animadvert upon the cruelty of employing infants in such laborious, dangerous, and abominable work as that of climbing and sweeping chimneys; but as a magistrate he felt bound to do all he could for the prevention of the practice, for in doing so, he was aiding in the prevention of crime. The climbing-boys, who were compelled to rise at three or four o'clock in the morning, finished their work at a very early hour. During the rest of the day these ignorant creatures were often permitted to run into the streets, and riot in dirt and idleness. They were addicted to gambling, and it was but natural that they should contract vicious habits.

The report, which was read by William Tooke, Esq. stated, that amongst various mechanical contrivances which had been tried, none had succeeded so well as that of Mr. Smart, which it was now proved by evidence, was calculated to sweep 95 flues out of 100, and that the remaining five, by the ready process of the ball and brush, or an iron door in the angle of the flue, could be better swept than by a boy. It recommended a renewed application to Parliament.

Sir Peter Laurie moved, that the report should be printed and distributed. He was glad to see so numerous an attendance of ladies, because it was on their humanity the society mainly depended for the abolition of the practice. The motion was carried unanimously.

Sir Francis Burdett said, he was most sorry to learn that the use of the machine for sweeping chimneys had rather diminished than increased. The cause of humanity had, indeed, in this respect, somewhat retrograded, but he was happy to find that this society, which many supposed to be dead, had only slept. From the evidence that had been given before the House of Commons on this subject, he was clearly of opinion that it was matter for legislative interference.—(Applause.) The public were, he believed, well disposed towards the cause, and in these cases the great difficulty to be conquered was a sort of acquiescing indolence. The existence of this practice was the peculiar disgrace of this country, for he believed it existed in no other, and foreigners had frequently cited the use, or rather the abuse of young children, in obliging them to climb chimneys, as testimony of the cruelty of the people. It would be presuming too much to suppose the meeting unacquainted with the cases of horrid cruelty which was proved, not only before the Committee of the House of Commons, but in the Courts of Justice, that this practice occasioned. Nothing could be more powerful than the simple statement of any one of those cases. The details of the evidence before the House of Commons were most affecting. Every man who had a child, must feel that he would submit to any privations, rather than subject an infant to so cruel a trade. It was the duty of the public to put a stop to it, because it was in their power to do so.—(Loud applause.) Now, he threw it out for the consideration of those who had a more competent knowledge, whether it would not be beneficial to limit the right of taking soot out of each parish. This right would of course be given to those who made use of the mechanical means of cleansing chimneys, and thus a double advantage would be produced—the odious and cruel evil would be abolished, and the public would have their chimneys swept for nothing.—(This suggestion was received with the loudest applauses.) He concluded by again recommending to the meeting a perseverance in this cause of humanity, and sat down amidst loud cheers, after having moved a petition to the legislature.

Lord Morley and Lord Gwydir also spoke in favour of the society.

Dr. Birkbeck stated that he always felt pleasure in witnessing the efforts of mechanical genius, but most particularly, when that genius was appropriated to the enlargement of human accommodation, and the preservation of human existence. That a subject so interesting and impressive, as the one before this meeting, should have escaped general notice, I should join the honourable baronet, said he, in wondering, if I were not myself, an example of the possible inattention and indifference, to a most painful instance of human suffering. I have often, I confess, listened in the dark and cold hour of the winter morning, to the plaintive voice of an unfortunate child, claiming admission into a house, in which it was about to be mutilated, perhaps even

destroyed, without acquiring an active determination to suppress a practice, extensively but inefficiently condemned. This neglect however, I will now endeavour to repair. The scientific ardour of the present time, having brought within my reach the application of a large body of mechanical talent, I pledge myself soon to place this subject before the mechanics collectively, over whom I have the honour to preside. It is impossible to believe, that if their minds are properly directed to the enquiry, success should not follow: wherever labour has required to be shortened or relieved, or difficulties in the exertions of men have been required to be overcome, mechanical ingenuity has been prompt and effectual; and shall invention be supine when an evil of such enormity demands a remedy? In placing this subject before the mechanics of the metropolis, I shall consider the construction of chimneys, and the methods of removing the soot which may have accumulated in them: where houses already exist, the latter subject is alone important, but where they are about to be built, attention may be paid to the form] of flues; and that as the noble lord near me, (Earl of Morley) has observed, ought even to be matter for legislative interference. Fortunately for the public, chimneys constructed in a manner best calculated for drawing, as it is termed, will always be the easiest to sweep; and thus it may be observed, one of the two evils, universally and proverbially pronounced to be the greatest in this life, (with the other of course we have no concern here,) will be most effectually avoided. If prejudice and indolence do not succeed in diverting us from this great object, I am confident we shall not fail in the introduction of mechanical chimney sweeping; for it is quite absurd to suppose, that mechanism cannot accomplish, whatever is possible for the crippled arms of an infant to perform. I do not think it necessary for me to make any remarks upon the conduct, however indefensible, of the master chimney-sweepers: the great evil rests with ourselves, not with the employers of children: we who permit the abuse of children in our service, are principally to blame. Whilst there exists a demand for climbing-boys, whatever may be the barbarity of the system, that demand will be supplied. I concur with those who have preceded me, in thinking that the practice cannot be effectually abolished without the aid of the legislature: it will I hope be soon brought again before the notice of both houses of parliament; and I would address to them, as well as to ourselves, what was once admirably expressed in reference to another instance of black oppression, already more than once alluded to —

> Hear it, ye senates! hear this truth sublime;
> He who allows oppression, shares the crime.

I shall not encroach longer upon the time of this meeting, than by reading the resolution entrusted to me—That until a total abolition be effected, this meeting will use its utmost exertions to introduce the use of machinery, by diffusing information on the subject; by encouraging the formation of societies through the country, and by holding out rewards to such master sweeps, as shall adopt and promote the use of machinery.

The resolutions were agreed to unanimously, and the meeting adjourned.

CHARCOAL.

An apparatus, called Charbonniere, has been invented by M. Mollerat, in France. This apparatus is so constructed as to extract the greatest possible quantity of charcoal from the combustible to which it is applied. In the carbonization of wood, 30 parts only in a hundred are fixed and produce charcoal, 15 parts are converted into gas, 20 parts consist of water in a state of evaporation, 20 of pyroligneous acid, and 15 of vegetable oil, which require no less than 250 degrees of heat to make it evaporate.

FRESH WATER.

As a means of preserving water at sea, an officer of the name of Ruyter recommends the use of a composition of resin and olive-oil well mixed with brick-dust, to which he gives the consistence of varnish. He renders the resin adherent by melting it with olive-oil, which unites itself with great facility to iron, with which it becomes perfectly combined when applied to it very hot. Its combination with the brick-dust gives it a sufficient degree of solidity without altering its adherent quality. This plastering, when applied to the inside of the casks, is not liable to be dissolved by water, which, on the contrary, increases its hardness, while it preserves the iron on the outside from being rusted. The author states, that he has employed this composition for several years on casks bound with iron hoops, which underwent no oxydization, and therefore rendered the use of pitch unnecessary.

ACCOUNT OF A SUTTEE AT CHITTOOR, IN THE EAST INDIES.
(By an Eye-Witness.)

"An instance of that most barbarous custom, at the bare mention of which nature shudders,—the immolation of a widow on the funeral pile occured here some days ago. Never having been present at a Suttee, I was anxious not to let the opportunity pass, and hearing that one was to take place, I hastened to the spot, which was on the bank of the river, about five hundred yards from the provincial court.

"Humanity had already led there a friend, whom I found in the midst of a great crowd, exhorting the infatuated woman to desist from her dreadful purpose. She was of a Bramin cast, and about 36 years of age; grief and want of sleep had given her an exhausted appearance, but her countenance and manners bespoke a strong mind, and she seemed in full possession of all her faculties. He had already been with her upwards of half an hour, yet his endeavours to persuade her were continued long after my arrival, and although he had the advantage of a perfect acquaintance with her language, all his arguments proved of no avail; she constantly replied that she was determined to die; and if prevented from burning, she would destroy herself some other way. As no personal consideration seemed to affect her, he appealed to her feelings as a mother, pointing to two children at her feet, a girl of 13 and a boy of 17 years of age. This merely led her to recommend them to his protection, he told her that if she thus willingly abandoned them, he would do nothing for them, but if she consented to live, he would protect and provide, both for her and them.

"Her relations were then intreated to use their influence, they were reminded that such a sacrifice was uncalled for by their religion. This they admitted provided she had not *left her house;* and regretted or affected to regret that measures had not been taken to prevent her doing so." They said "Why does not the company prohibit these sacrifices? Widows would not then form the resolution. It must now of necessity take place; for were she to forego her resolution some calamity would befall the town." An old woman, sitting close by her side added, "We would in that case tie her hands and feet, and force her on the pile." The Bramins now came to remind her that all was ready; indeed she had herself more than once expressed great impatience at the delay, telling us that we were detaining her husband unnecessarily in the sun. We conceived that further entreaty would be of no avail, and followed her to the pile which was about 30 yards off. A faint hope was still entertained that the sight of it would shake her resolution; but although I was close by her side, and purposely kept my eyes steadfastly fixed upon her, not the least emotion was evinced even when she ascended it; on the contrary she seemed pleased that her wish was now about to be accomplished, and seated herself by the side of the body, making obedience to it.

"The Bramins now proceeded to remove the ornaments from her neck and arms, and as there was at this time a great scramble for some limes given her for distribution, she seemed fearful of their (the ornaments) being stolen, and was observed anxiously to follow them with her eyes into the hands of some females, who were waiting to receive them. She was then directed to lie down, a Bramin placing her left arm under her husband's head; the right across his breast; and her right foot over his legs. Several frivolous ceremonies now took place; the covering from the face and breast of the deceased was now removed, a lighted stick being placed on the latter, incense was sprinkled upon it. Some oil was poured from a leaf into the ears, and a small silver coin placed between the lips, a Bramin vociferating all the time some sentences in *Sanscrit*, which was repeated by another on the opposite side of the pile. While these absurdities lasted, which was about half an hour, the poor woman lay with her eyes closed, and without once moving from the position in which she was placed.

"The awful moment having arrived, when the pile was to be kindled, one more appeal was made to the feelings of her relations. They replied as before that it was too late, and they could not interfere. The deluded creature was then called upon to say whether she still persisted in her resolution. She raised her head for an instant, cried "Yes, Yes," and made a movement with her hand not to be again importuned. Perhaps you may with myself, have been led to suppose that painful as such a death must be under any circumstances, matters are so arranged as to render the victim's sufferings as short as possible; it was far otherwise, in the present instance. Had torture been the object in view, it would have been difficult to devise a more ingenious method; but to convey to you an idea of the horrid scene we now witnessed, it is necessary to describe the pile.

"It consisted of such bundles of wood as are usually brought from the Jungles for fuel, heaped up to the height of four feet,

and may have been about seven in length, and six in breadth. Above this at the distance of four feet, was another layer of wood placed over two heavy beams, the ends of which were fastened by ropes to four upright posts and close to each of these stood a man with a hatchet ready to cut the ropes asunder.

"The pile was now lighted at the four sides by a near relation; when we expected and indeed desired to see an instantaneous blaze. Instead of this the fires made the slowest progress; if any combustible matter was mixed with the wood, it must have been in the centre of the pile, and too distant to shorten the agonies of the unhappy woman.

"Some powdered *dammer* was sprinkled upon the fires when first lighted, but too sparingly to be of use.

"As soon as the fires were kindled, and without waiting until the flames had made some progress, the ropes which supported the upper wood were cut away, and the beams which lay, one across the poor woman's chest and the other over her legs, effectually prevented escape when nature should overcome her resolution. We could however as we still stood close to the pile, distinctly perceive, not only the writhings of her right arm and leg, but the whole upper part of the pile was seen to heave with her struggles; and we should no doubt have heard the most piercing shrieks, had the noise permitted; but from the moment she approached the pile, all was clamour and confusion, and on its being kindled there was incessant shouting, and beating tom toms, or native drums.

"In this state (with a weight upon her, just sufficient to cause the most excruciating torment, without extinguishing life) she remained full five minutes, before either the heat or smoke could have reached her. As these approached, her exertions became stronger, and in about three minutes more, the flame came in contact with her right foot, which was nearly in a line with the extremity of the pile, when we hastily withdrew from the revolting sight.

"If any circumstances could render such a scene more disgusting it, was the want of feeling evinced by those present. As she ascended the pile some females who attended her screamed, but they became composed again immediately, and this was the only expression of grief remarked if grief it can be called; some time before she was brought to the pile, and while seated in the midst of the crowd, a basket was placed before her containing rice, a red powder, and small pieces of palmyra leaf dyed of the same colour. These it was intended she should herself distribute but being out of humour at the delay which she supposed our entreaties had occasioned, she spurned the basket from her, and the contents were handed out by a woman who sat near; every one was anxious to obtain a part and the little incidents consequent in such a scramble (upsetting of turbans, &c.) were the occasion of much mirth, and none enjoyed it more than some females seated close behind her. A young woman in particular was remarked, who having reached the basket with much difficulty, withdrew, waving her trophy in the air with the greatest glee.

"The following statement was given to me by an intelligent Bramin whom I requested to furnish me with an estimate of expences of a Suttee ceremony.

	Rupees.
Cloth for the widow on bathing after her husband's death	9
Expences necessary for obtaining the permission of the Bramins, to sacrifice herself; betle and cloths to them, and to women	77
Cloth for the widow, on bathing after accompanying the dead body of her husband to the place of burning	9
Expences necessary for obtaining the further orders or sanction of the Bramins to burn, and for distributing alms amongst them, and cloths and ornaments to Bramin's women.	93
Sandle wood, camphor, oil, ghee and fire wood.	70
Amount required for distribution among the Bramins after the widow has ascended the pile	35
Amount required for the daily economy for ten days after the widow is burnt, and which sum goes to the officiating Bramins	35
Expence necessary from the 11th to the 13th day after the ceremony of cloths, cows, brass vessels, required to present to the Bramins and women	105
Expences of giving rice to Bramins	140
Further amount required for distribution among Bramins	105
Charges for erecting a Brindavan, or Pagodee on the spot where the woman burnt herself and for planting flower trees thereon	70
Total Rupees	753

To the Editor of the Mechanics' Register.

Sir—I take the liberty of transmitting the following TABLE of METALS, which, as you have recently completed the Lessons on Mineralogy may be acceptable to your readers. It is extracted from Dr. Ure's Dictionary of Chemistry, and is therefore correct :—

NAMES.	Sp. gr.	Precipitants.	Colour of Precipitates by Ferroprussiate of potash.	Infusion of galls.	Hydrosulphurets.	Sulphuretted hydrogen.
Platinum	21.47	Mur. ammon.	0	0		Black met. powd.
Gold	19.30	Sulph. iron Nitr. mercury	Yellowish-white	Green; met.	Yellow	Yellow
Silver	10.45	Common salt	White	Yel.-brown	Black	Black,
Palladium	11.8	Prus. mercury	Deep orange		Blackish-brown	Black-brown
Mercury	13.6	Common salt Heat	White passing to yellow	Orange-yellow	Brownish-black	Black
Copper	8.9	Iron	Red-brown	Brown	Black	Ditto
Iron	7.7	Succin. soda with perox	Blue or white passing to blue	Protox. 0. Perox. black	Black	0
Tin	7.29	Cor. sublim.	White	0	Protox. black Perox. yellow	Brown
Lead	11.35	Sulph. soda	Do.	White	Black	Black
Nickel	8.4	Sulph. potash?	Do.	Grey-white	Do.	0
Cadmium	8.6	Zinc	Do.	0	Orange-yellow	Orange-yellow
Zinc	6.9	Alk. carbonates	Do.	0	White	Yellowish-white
Bismuth	9.88	Water	Do.	Yellow	Black-brown	Black-brown
Antimony	6.70	Water Zinc	With dilute solutions white	White from water	Orange	Orange
Manganese	8.	Tartr. pot.	White	0	White	Milkiness
Cobalt	8.6	Alk. carbonates	Brown-yellow	Yellow-white	Black	0
Tellurium	6.115	Water Antimony	0	Yellow	Blackish	
Arsenic	8.35? 5.76?	Nitr. lead	White		Yellow	Yellow
Chromium	5.90	Do.	Green	Brown	Green	
Molybdenum	8.6	Do.?	Brown	Deep brown		Brown
Tungsten	17.4	Mur. lime?	Dilute acids			
Columbium	5.6?	Zinc or inf. galls	Olive	Orange	Chocolate	
Selenium	4.3?	Iron Sulphite am.				
Osmium	?	Mercury		Purple passing to deep blue		
Rhodium	10.65	Zinc?	0		0	
Iridium	18.68	Do?	0	0		
Uranium	9.0	Ferropr. pot.	Brown-red	Chocolate	Brown-yellow	0
Titanium	?	Inf. galls.	Grass-green	Red-brown	Grass-green	0
Cerium	?	Oxal amm.	Milk-white	0	White	0
Potassium	0.865	Mur. plat Tart. acid	0	0	0	0
Sodium	0.972					
Lithium						
Calcium						
Barium						
Strontium						
Magnesium						
Yttrium						
Glucinum						
Aluminum						
Thorinum						
Zirconium,						
Silicium						

The first 12 are malleable, and so are the 30th, 31st, and 32d in their congealed state.

The first 16 yield oxides, which are neutral salifiable bases.

The 17th, 18th, 19th, 20th, 21st, 22nd, and 23rd metals, are acidifiable by combination with oxygen. Of the oxides of the rest, up to the 30th, little is known. The remaining metals form with oxygen the alkaline and earthy bases.

Your obedient servant,

H. W. Dewhurst,

21, Francis-street, Tottenham-court-road.

A CHEAP, INFALLIBLE, AND PORTABLE BOOT-JACK.

2

1

Fig. 1, consists of a piece of tough leather, about eighteen inches long and an inch and a half wide, the ends of which are to be firmly sewn together with wax end, having an incision cut as represented at *a*, the opening of which must be sufficiently large to admit of the foot of the boot to be pulled off passing through, as shown at *b*, in Fig. 2, one part resting on the instep the other on the heel; the toe of the other foot is then to be thrust into the vacancy at *c*, when, by a little exertion, the tightest boot may be drawn from the leg with the greatest certainty. A boot jack of this description is cheap, because it cannot cost more than one shilling; portable, because it may be conveniently carried in the coat pocket, or rolled up into a very smull compass; and infallible, because it has an equal purchase on the instep and heel, without the possibility of the boot slipping out.

Southville. S. Hollands.

NEW METAL.

A new metallic composition has lately been invented by Dr. Geitner, an able chemist in Saxony, the properties of which closely resemble those of silver. It is malleable, is not subject to rust, and is not liable to become tarnished. This composition has already been made use of in the manufacture of candlesticks, spurs, &c. and will in all probability (according to some of the foreign scientific journals) be converted into a substitute for plated goods.

AMERICAN MANUFACTURES.

Almost every description of manufactured goods has recently advanced in the European market.—The rise of cotton in England has been already felt in this country. Hardware and woollens have also advanced in the English market and it is stated the latter article had risen 30 per cent. in the French market. English dry goods, it is said, are now sold in the New York market about 15 to 20 per cent. higher than they were six weeks since. The advance of cotton has been felt throughout the country, and given a briskness to the circulation of that article through the hands of consumers and speculators from Maine to Missouri. The causes of this have been sought for in the new markets, which have been offered by the permanent establishment of South American independence, and the new projects in England and on the Continent, which demand great quantities of raw material.—*American Paper*.

SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

On Monday last, the annual ceremony of distributing the various medals and other prizes awarded by this excellent society, took place at the King's Theatre in the Haymarket. The whole of this magnificent and extensive building was completely filled with elegant dressed company, of whom the majority were ladies, and the assembly was one of the most splendid we ever witnessed. The front of the stage was occupied with seats for the more distinguished visitors, among whom we observed the Duke of Somerset, Joseph Hume, Esq. M. P. Dr. Birkbeck, Admiral Donolly, Mr. Wilmot Horton, &c. &c. The Canadian chiefs were also present, and their singular costume excited much attention. The whole space at the back of the stage filled with seats rising above each other, and at the upper part a full military band was stationed, for the purpose of entertaining the numerous assembly by the performance of a number of airs from Weber and other eminent composers.

His Royal Highness the Duke of Sussex, the president of the society, took the chair at one o'clock. Upon the entrance of his Royal Highness, the band played the national air of "God save the King," while the spacious theatre rang with the plaudits of the company, who rose from their seats and remained standing till the tune was completed.

As soon as silence was restored, his Royal Highness proceeded to open the business of the day.—He said he had to congratulate the society and the friends of improvement generally, on the numerous meeting which had this day assembled to witness the distribution of those rewards which the society had thought proper to grant to different individuals. The number of medals and premiums awarded afforded a proof of the activity which had pervaded the society during the last year; and the elegant assembly who now crowded this immense fabric showed the interest which the public in general took in their proceedings. He would not delay the company longer by any address of his, but would call on the worthy secretary to make his report; and he would then proceed to the distribution of the different prizes to those individuals whom the society had thought worthy of their fostering notice.

Arthur Aikin, Esq. the secretary, then read the report which contained a concise and comprehensive account of the origin and progress of the society, and the motives which had occasioned the selection of a day, at the close of each session, for the distribution of rewards to the successful candidates. The report also expatiated upon the advantages which had resulted from the establishment of the institution, and proceeded to observe that the society had been accused of too much liberality in bestowing their rewards, upon which subject some difference of opinion existed in the society itself. „One party said, that those who applied for premiums ought to be subjected to the most strict severity of scrutiny; but, on the other hand, it was contended, that more lenity should be observed, since, by a fair and liberal encouragement, progressive improvement was likely to be produced. This latter principle was the more insisted on, because it was felt that the efforts submitted to the society must depend on age and opportunity as well as on the capacity of those applying; and on these grounds the more liberal feeling still continued to be adopted. The secretary then proceeded to name the persons to whom, during the present session, rewards, either honorary or pecuniary, had been voted by the society

AGRICULTURE AND RURAL ECONOMY.

Ralph Creyke, jun. Esq. of Rawcliffe-house, Yorkshire, received the large gold medal, for warping, by an improved method, 429 acres of peat. This land, it appeared, which bore no crop four years ago, was now, by the skilful process of Mr. Creyke, worth 35s. per acre per annum.

The Royal Chairman, in investing this gentleman with the medal, shortly expatiated on the benefits which the country must derive from such patriotic exertions, and wished him every success in his future efforts to reclaim from waste those lands on which he understood he was now employing his art and capital.

In giving to Colonel James Wilson, of Sneaton Castle, near Whitby, the large gold medal, for planting 147 acres with forest trees, the Royal Chairman took occasion to point out the immense importance of the growth of timber to this great maritime country. Those, he conceived, who planted trees which were likely to uphold the "wooden walls of old England," were entitled to the best thanks of their country. (Cheers.)

Several other premiums were distributed in this class, among which was the silver Ceres medal to Mr. Salisbury, for his communication on the subject of the material employed in Tuscany for the manufacture of fine plait. In the observations which His Royal Highness made in presenting the medal, he took occasion to pay a handsome compliment to Dr. Birkbeck who

was seated near him, on his indefatigable exertions as President of the London Mechanics' Institution.

CHEMISTRY.

The first premium distributed in the class of Chemistry was the large silver medal, and 50 guineas, to Mr. John Roberts, of St. Helen's, Lancashire, for the invention of his admirable Hood and Mouth Piece, to the merits of which we have had frequent occasion to advert. The secretary stated that of the substances composing the atmosphere, 21 per cent. consisted of a gas, for the loss of which nothing could compensate, while the remaining 79 parts were unfit for respiration. It often happens that the air is loaded with noxious vapours, some of which may be separated by means of water, and upon this principle Mr. Roberts's apparatus is constructed. Mr. Aikin then alluded to the experiments performed on the premises of the London Mechanics' Institution, which have been minutely detailed in our pages, and were witnessed by the committee of the Society of Arts. He observed, that as philosophical experiments, they were extremely interesting, and in their application of a very important nature, for this discovery would enable firemen and others, to go into rooms which they otherwise could not enter—and it would be of especial service in checking fires on board ships. It would also be useful, in preventing persons employed in various manufacturing processes, from inhaling dust, or particles prejudicial to health.

His Royal Highness, on presenting the reward to Mr. Roberts, complimented him very highly on his excellent invention, which, in all probability, would be the means of *saving thousands of lives and millions of property*. This reflection must be a source of great gratification to him; and his Royal Highness felt great satisfaction in seeing that an individual, in the humble capacity of a miner, had applied himself to the discovery of an apparatus which promised so much benefit to mankind. It was by such endeavours as this, that we were enabled to keep that link which binds together all classes of society, and upon the preservation of which depends the security, happiness, and pride of this country.

The observations of his Royal Highness were received with three cheers; and Roberts having, at the request of his Royal Highness, put on his apparatus in a few seconds, advanced towards the audience, and after bowing to his Royal Highness and the company, retired.

To Mr. W. Sturgeon, Artillery-place, Woolwich, for his improved electro-magnetic apparatus, the large silver medal and 30 guineas were awarded. The principal feature in this improvement is, the decrease of the size of the Galvanic battery, which is one of the dearest parts of the machine, and is, at the same time, the most difficult to keep in order.

The Royal Chairman, in announcing to Mr. Sturgeon the decision of the society, observed that he understood the individual whom he was then addressing was formerly in the artillery, and was now a pensioner of that meritorious corps. Although he pursued the humble calling of a shoemaker, he, however, found time sufficient to attend to scientific and useful pursuits. While they had such power of mind—while they possessed such great, and such well-directed intelligence in this country—intelligence not confined to any one rank, but strengthening and ornamenting all—it was impossible that this great empire should not prosper and triumph under the blessing of Divine Providence.—(Cheers.)

MECHANICS.

There were fifteen premiums given in this department.

Mr. W. Hardy, Wood-street, Spa-fields, obtained the gold Vulcan medal for an instrument to ascertain very small intervals of time.

The Secretary stated, that this instrument was so excellently constructed that it would divide a second of time into 200 equal parts. It was used in the first instance, at Woolwich, by the artillery officers in throwing shells and other projectiles, and it had since been introduced at the Royal Observatory at Greenwich. It was admitted by all who had examined it to be a very extraordinary piece of mechanism.

After the remainder of the honorary and other rewards in this class had been distributed, his Royal Highness delivered those adjudged to the various candidates whose inventions were connected with the Manufactures, Colonies and Trade, and the Polite Arts, addressing each of the individuals with some appropriate observations, and conducting the interesting business of the day with the utmost condescension and urbanity.

When the whole of the rewards, amounting to one hundred and seventeen, had been given, the Royal Chairman said, it only remained for him to express to the company then present, in the name of the Society, their acknowledgments for the distinguished honour which had been conferred on them by the numerous attendance of ladies and gentlemen on the present occasion. He trusted that the spectacle

had given satisfaction, and he had further to add, that those who were anxious to see the different performances which had been entitled to premiums, might gratify their curiosity, during the next 14 days, at the company's house in the Adelphi. He had no doubt, that the attendance of so numerous an assembly, this day, would have the effect of stimulating individuals to make still greater exertions in the ensuing year.

His Royal Highness then withdrew, amidst the cheers of the crowded assembly.

FAMILIAR LESSONS ON GEOLOGY.

Earths are commonly understood to be composed of substances neither metallic nor inflammable, though many of this class contain various proportions of the former,* and a few are combined with the latter.

The beginner must inform himself of the names of these substances generally called *earths;* they are but few, and those most commonly met with are only five, viz. the *siliceous, calcareous, argillaceous, magnesian,* and *barytic;* to which is added the *strontian;* none of which have been hitherto met with in a state of purity, being also associated with one or more substances either chemically combined or mechanically compounded.

These we propose to treat of in the following treatise, and to endeavour to explain their general characters and the peculiarities which may distinguish them from each other, in the common state of their ordinary appearances.

There are three other earths which are very little known, viz. *zirconia,* which has only been found in Zircon and Jargoon; also *glucine* and *yttria;* but these very seldom occur, and should the beginner be desirous to know more of them, he had better consult an elementary work.

The earths above named are very limited. *Barytes* is not uncommon in this country; *strontian* may be said to be seldom met with; and *zirconia, glucine,* and *yttria,* are of rare occurrence; zirconia exists in the zircon; glucine exists in the emerald; and yttria in the gadonolite.

The surface of the globe, mountains, valleys, the bottom of the deep, and the whole united mass of the terrestrial orb, are comprised in the general term EARTH, and are believed to be composed of the four† first named, blended or combined in all the degrees and forms in which the Infinite Power, who created it, has thought fit to present it to our view.

As siliceous substances are in greater proportion than any of the others, we will endeavour to shew how they may generally be known.

Siliceous earth or *silex*‡ occurs in great abundance in granite, which is composed of quartz§ and felspar, a substance dissimilar to the former, and also of mica, very different to both; these are understood to have been the first chemical deposits when earth obeyed the Almighty fiat, separated from chaos, and formed (the greater part of it) the globe, the immense mountains of *granite* and *granitic rocks,* which sometimes alternate with others, supposed to be of the same primitive— the earliest formation.

Granite forms the highest mountains, some of which are the most rugged and peaked that have hitherto been explored, also the general tract of Alpine countries, and the deepest ravines,‖ having frequently immense tracts of various formations betwixt its lofty points forming mountains of different elevations, rocks, hills, and valleys of great extent, or ravines more or less confined.

Of this almost universal formation (granite) the substance called quartz, forms a predominent part, and may be known from its associates, *felspar* and *mica,* by observing the following characters. As some varieties of *granite* are very small grained, consequently the component parts are more difficult to be distinguished, than others, therefore we recommend to the beginner, first to examine specimens of the large grained granite, in which the three substances may be distinctly seen, and to notice with attention, the constituent parts separately, as quartz, felspar, and mica.

Quartz (silex) the immediate subject of our enquiry, has generally a shining lustre, is of a light colour, and not unlike glass, the fracture is uneven, irregular, not of any determinate form; it is often embedded in felspar, and when broken across, sometimes

* Iron for example, forms the colouring matter of a great many substances, as red sandstone, clays, gypsum, &c. &.

† Siliceous, calcareous, argillaceous and magnesian.

‡ Silex. lat. flint.

§ The word silex has given way to that of quartz, which will in future be used in this little treatise.

‖ Imagine a valley of any extent between two lofty points of granite, to have been subject to repeated influx and inundations, which have brought together, as into a reservoir, both animal and vegetable remains; also the decomposed particles of its confines; such a tract would present a very different appearance from that of granite, and would constitute what is termed the filling up or flat formation, consisting of stratified and homogeneous deposits.

resembles Hebrew characters. It is often opake, approaching to white, and not unfrequently smoky, of different shades of brown; these are its usual appearances, though it is sometimes yellow, pale, or deep pink, and approaching to red, also violet, blue, &c. It is hard to the knife, but a good file will make an impression.

Quartz¶ appears massive, also in regular and irregular forms, compressed or aggregated. If diaphanous and very fine, it is then called crystal or rock crystal, some varieties of which are of various colours, as has been before stated. Silex is also in great abundance in other rock formations besides granite, quartz forms extensive veins, patches of great magnitude, skirting or covering rocks, and there are few metals that it is not associated with.

(*To be resumed.*)

VORACITY OF TADPOLES.

SIR—Being lately engaged in trying the power of some microscopes, I procured several small objects from the ponds in the vicinity of Camden Town, and among others I had some of those little animals commonly called Tittle-bats, and also some very small Tadpoles out of the same pond, which I suffered to remain in the same bottle for future experiments, not imagining that any harm could happen to the fish; but guess my surprise when upon examining the bottle two days afterwards, not a fish was to be found in it. Upon a very minute examination, I discovered the Tadpoles in very good spirits, and that my fish had been reduced to *perfect* skeletons, except that their eyes remained untouched. I have tried the experiment twice since, and in both cases with the same result. I have mentioned the case to our excellent President, Dr. Birkbeck, and several other gentlemen, and they all appeared not to be aware of the fact. Should you think the subject worth publishing in your valuable and widely ciroulated REGISTER, you are welcome to do so; and as Tadpoles arrive at their proper size about this time, it may enable others to try experiments and make preparations perhaps of value to the Naturalist.

I am yours, &c.

T. BLUETT.

DEWSBURY MECHANICS' INSTITUTION.

On Wednesday the 17th ult. a meeting was held at the George Hotel, Dewsbury, in pursuance of public notice, for the purpose of establishing a Mechanics' Library and Institute in that town. Thirty-six individuals entered their names as members; another meeting was appointed to be held on the 3d June, in Ebenezer school-room, for the purpose of receiving additional names, and adopting rules for its government, &c. We understand the liberal plan recommended by Mr. Brougham on the "Education of the Working Classes," is likely to be adopted.—*Leeds Mercury.*

EXPEDITIOUS WORKMANSHIP.

A mechanic, in the employment of Mr. Simon Hamer, contractor for the new canal at Knottingley, has undertaken, for the small wager of five guineas, to complete a cart wheel in five hours, in a workmanlike manner: the nave to be ready turned and hooped, the felloes and spokes to be from the axe and saw, the wheel to be not less than four feet four inches in diameter, and its strength in proportion to its size. This work is to be done in his own shop, near the house of Mr. Mark Hepworth, the Dog Inn, in Knottingley, on Monday, the 13th instant.

DEVIL'S TREE.

There is a tree which they call the Devil's Tree, growing in America, its fruit in a state of maturity is *elastic,* and when dried by the heat of the sun, noisily splits and bursts forth its grains. To this sport of nature the tree owes its name, for at the moment of bursting, the effect of a piece of artillery is produced, the noise of which succeeds rapidly, and is heard tolerably far off. If its fruit be transplanted before it is ripe to a dry place, or exposed on a chimney-piece to a gentle heat, it will have the same effect and produce the same phenomenon.

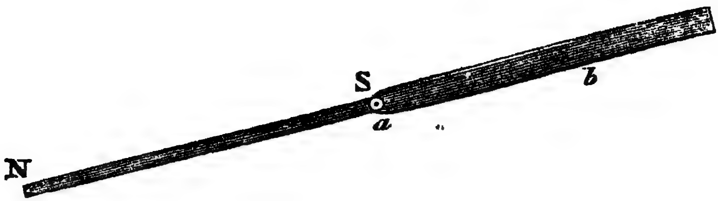
ON THE DIPPING NEEDLE.

Sir—Your very ready insertion of my former communication in your admirable Register, has encouraged me to send the present letter, on the subject of the Magnetic Needle.

That the south pole of our globe attracts the south pole of the Needle is I believe generally admitted, but I must confess that I am not positive of the fact; but if such is the case the present mode of fixing the needle is very imperfect for ascertaining the dip, as each pole counterbalances the other, and consequently, the dip is the difference in the counteraction of the poles, and not the true inclination. To remedy this defect it is required to annihilate the counteraction

¶ Quartz melts with soda (potash), and orms glass.

that one pole has over the other. The method that I have invented to accomplish this desirable object is represented in the following figure:—



DESCRIPTION.

a. the axis; N, the north pole; S, the south pole. *b*, is a piece of ivory equal in weight to the magnet N, S, joined to the needle, so that its south pole terminates at the axis. Now it appears evident to me that by this arrangement the south pole will have no influence to counteract the north pole, so that the north pole will have its inclination uninterupted, and therefore the true dip must be the result. By this simple means a north pole dip and a south dip might be had and likewise a north compass and a south compass.

I am, Sir, your humble servant,
DAVID THOMAS.

Surrey Coffee House, Borough.

*** If the preceding communication should meet the eye of MR. POPE, whose attention has been so usefully directed to this important subject, we shall be happy to be made acquainted with his opinion of our correspondent's suggestion.—ED.

QUERIES.

No. 26.

SIR—You would oblige me by inserting the following query, if you consider it worthy of notice. It has been evident to me, from some experiments that I have seen in the lecture-room of the London Mechanics' Institution, that currents of air, though small, do exist in the atmosphere at a very little height from the earth: I wish to know whether the rays of light reflected from one mirror to another (as proved by MR. PARTINGTON) and the rays of heat reflected as the former (as proved by Mr. OGG) actually proceed in straight lines, showing that they overcome the resistance of such currents when the electric fluid, which seems much stronger, does not.

S. M. T.

No. 27.

SIR—If any of your numerous correspondents will inform me of the reason why hay-stacks, &c. which are put up in a damp state, take fire, I shall be much obliged to them.

Blackfriars. G. T. P.

No. 28.

SIR—I shall feel obliged if any of your correspondents will inform me through the medium of the MECHANICS' REGISTER, the best mode to take out grease from coloured silk, without discharging the colour, and they will oblige

Your humble servant,
Finsbury, May 28, 1825. C. T. S.

No. 29.—COCHINEAL.

SIR—In consequence of the extraordinary high price of cochineal, an idea has occurred to me that a dye might be invented to answer the same purpose, and at far lower rate, but free from the extraneous and resinous qualities of the common lac dyes. If you would be good enough to insert this in your well known REGISTER, I have no doubt that some of the contributors to its instructive pages will be able to give me their opinion of the practicability of discovering such a substitute.

Your obedient servant,
Vauxhall, May 28, 1825. S. S.

No 30.

To make a soap that will remove grease spots, &c.

No. 31.

To make a French polish.

No. 32.

Receipts for making good sealing-wax and wafers.

INQUISITUS.

No. 33.—OPTICS.

SIR—I should feel obliged if any of your correspondents could inform me of a method by which two concave glasses may be joined together so as to admit of spirits of wine or turpentine being introduced be-

tween them, as described by Mr. PARTINGTON, (vol. 1, page 247.)

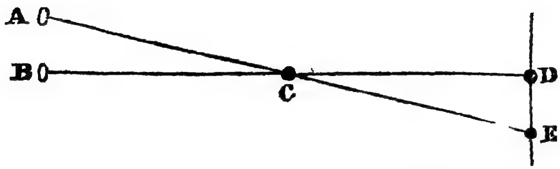
And also for the best metal for the purpose of constructing a burning mirror.

P. B. E.

No. 34.

OPTICAL QUESTION.

Sir—Should the following query be deemed worthy a place in your Register, I shall be obliged by its early insertion. Upon looking at an object (for example, an upright post) with both eyes, I perceived that it appeared to be placed on a certain part of a wall at some distance beyond it, and on looking at the same object with the right eye alone, it was seen on the wall in the same place; but on viewing it with the left eye only, the post appeared at a different place on the wall. This diagram will, perhaps, better explain what I have said.



Let A, B, be the two eyes, C, the object, and D, E, the wall in the distance. Now, on looking at C with both eyes, or with the right eye only, it appeared placed on the wall at D, and with the left eye alone, it was seen at E.

Probably some of your readers acquainted with optics will have the goodness to explain this extraordinary circumstance, why the object is not seen in the same place when viewed by the left eye, as well as by the right eye, or by both eyes. I say extraordinary, because the natural inference which it appears might be drawn, would be either that if an object could be seen placed in a certain position when viewed with both eyes and also with the right eye alone, it would be in the same place when seen with the left eye alone; or that if by the right eye it was seen in one place, and by the left in another, when seen with both, it would be observed in some place situated between the two.—I am, &c. F. X.

ANSWERS TO QUERIES.

QUERIES Nos. 3 and 4, page 16.

AEROSTATION.

Woolwich, May 28, 1825.

SIR—H. S. (page 16, vol. 2.) requests to know the quantity of sulphuric acid, iron filings, &c. that will suffice to fill with gas a balloon of a spherical form, ten feet in circumference. He also wishes to be informed whether tissue paper varnished with linseed oil, will answer the purpose of constructing this balloon. In answer to his first enquiry, I shall begin by stating, that iron generally yields about 1700 times its own bulk of gas, or four and a half ounces of iron; the same weight of sulphuric acid, and 22 and a half oz. of water, will produce about a cubic foot of gas. Or six ounces of zinc, an equal quantity of sulphuric acid, and 30 ounces of water are necessary for producing the same volume of gas. Zinc, though more expensive, yields a much lighter gas than iron; therefore, supposing 16,88 to be the contents in cubic feet of a balloon ten feet in circumference, then it will, agreeably with the before-mentioned statement, require 4lb. 12oz. 8drs. of sulphuric acid, the like quantity of iron, and 23lb. 14oz. 8drs. of water to generate a sufficient quantity of gas. But as we cannot expect to have all the joints tight, and as the action very soon diminishes unless the iron is kept well agitated, I would recommend the use of a larger quantity of the materials, in order to produce the best and most certain effects, as it requires much care and attention to procure from the above proportion the quantity of gas before stated.

To his second question I have only to say that I have used tissue paper in the construction of balloons much larger than he mentions, some of which have been eight and ten feet in diameter. I always use boiled linseed oil as a varnish, and find it answer very well. The greatest objection to it is, that the balloons so varnished become very rotten, and when folded cannot be again opened without danger of rending them, the oil causing them to adhere so firmly together.

I am, Sir, yours truly,

JAMES MARSH.

QUERY, No. 2, page 16.

FORMATION OF PEARLS.

SIR—In answer to an enquiry in No. 29, of your REGISTER, I beg leave to offer the following remarks:—

Pearls are found in a shell fish of the oyster kind, but the formation of them has puzzled both ancient and modern naturalists, and has given occasion to several hypothesis. Pliny, Solinus, and others of the ancients, suppose them formed of the dew which (say they) the fish rises every morning to the surface of the water, and opens its shell to imbibe; but this is manifestly false, the pearl oysters growing fast to the rocks, and never rising to the surface. Others will have pearl to be the eggs of the fishes that produce them, but this does not consist with the phenomena, for they are found through the whole substance of the oyster: in the head, the coat that covers it, the stomach, and in general in all the fleshy and musculous parts, so that there is no reason to think that pearls should be in oysters what eggs and spawn are in fowls and fishes. This indeed may be said, that there is a multitude of little eggs in form of seed, some whereof grow and ripen whilst the rest continue nearly in the same state, so in each oyster one pearl is usually found larger than the rest, and which ripens faster than the others; and sometimes this grows so large as to hinder the oyster from shutting, in which case the fish rots and dies.

In the memoirs of the French Academy, M. Reaumer has a very curious piece on the formation both of shells and pearls; where he observes, that pearls are formed like stones in other animals as those of the bladder, kidneys, &c. and that they are apparently the effects of a disease in the fish, deriving their origin from a juice extravasated out of some broken vessels, and detained and fixed among the membranes. To evince the possibility of this, he shews that the shells of sea fishes as well as those of snails, &c. are wholly formed of a glutinous strong matter oozing out of the body of the animal; and therefore it is no wonder that such animals as have vessels containing a sufficient quantity of strong matter to build and extend the shell, should have enough to form stones in case the juice destined for the growth of the shell should happen to overflow, and burst forth on any cavity of the body, or among the membranes. To confirm this system, he observes that the inner surface of the common pearl muscle is of a mother-of-pearl colour in one part, and reddish in another; and the pearls found in this fish are likewise of two colours exactly corresponding with those of the shell, which shews that in the same place wherein the transpiration of a certain juice had formed a coat or layer of shell of a certain colour, the vessels which conveyed that juice being broke, a little mass or collection of it is formed, and hardening, becomes a pearl of the same colour with that part of the shell to which it corresponds. Pearls have this advantage over precious stones dug out of rocks, that the latter owe their lustre to the industry of men, but the former are born with that beautiful water which gives them their value; they are found perfectly polished in the abysses of the sea, and nature has put the last hand to them ere they are separated from their mother.

There is a curious method of making counterfeit pearls, which was discovered by the Sieur Janin, and seems worthy to be described. This artist having observed that the scales of the little fish called the Bleak, had not only all the lustre of the real pearl, but that after beating them to powder in water, they returned to their former brilliancy upon drying, he bethought of setting a little mass thereof in the cavity of a bead, made of a kind of opal, or glass, which had likewise a pearly colour. For this purpose he made use of a glass tube about six inches long, sharp at one end, and somewhat crooked, through which he blowed a drop of the matter into the bead, and to spread it equally throughout the inner circumference, shook it gently a long time in a basket lined with paper. The pulverised scales fastened by this motion to the inside of the bead, resume their lustre as they dry, and nothing remains but to stop up the aperture, which is done by melted wax conveyed into it with a tube like that used in introducing the dissolved scales. The superfluous wax being cleared away the beads were perforated and strung, and then formed into necklaces.

I remain, yours respectfully,
JOHN H. BARRETT.

QUERY, No. 8, page 30.

Indian rubber may be dissolved in oil of turpentine, and most of the essential oils.

P. B. E.

LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communications (*post-paid*) are requested to be addressed.
Sold by SHERWOOD, JONES, & Co.; Paternoster Row; and may be had of al Booksellers and Newsmen.

SUPPLEMENT TO THE LONDON
MECHANICS' REGISTER.

No. 34.] SATURDAY, JUNE 4, 1825. [Price 3*d*.

LONDON MECHANICS' INSTITUTION.

MR. LEWTHWAITE's FOURTH LECTURE ON ELECTRICITY.

ATMOSPHERICAL ELECTRICITY—IDENTITY OF LIGHTNING AND ELECTRICITY—DR. FRANKLIN'S EXPERIMENT—DESCRIPTION OF A THUNDER-STORM—ELECTRICAL KITE—OBSERVATIONS ON LIGHTNING CONDUCTORS—WATER-SPOUTS—FORKED AND SHEET LIGHTNING—EARTHQUAKES—AURORA BOREALIS, &c. &c.

WEDNESDAY, 25TH MAY.

Mr. Lewthwaite, after briefly referring to the principal facts illustrated in his previous lecture, proceeded to observe that as the minds of his hearers were now sufficiently prepared for the consideration of *Atmospherical Electricity*, he should this evening direct their attention to that subject. Hitherto the science of Electricity embraced no wider range than the phenomena developed during the excitation of glass, &c., and had therefore not yet connected itself with any of the great events of the material world. Astronomy had elevated the mind to the contemplation of the most splendid and magnificent phenomena that the imagination could comprehend;—Optics had dared to investigate the properties of that etherial matter, which constitutes the very soul of the visible world;—and Magnetism had connected her facts with the polar attraction of the great globe itself. It had indeed been conjectured, that the *shock* and the *spark* of the electrical machine were miniature effects of a more tremendous agent; but it was reserved for Dr. Franklin, not only to give a form and character to this infant science, but to raise it to a higher rank among the other great divisions of human knowledge.

The discovery of the identity of *electricity* and *lightning* was the step by which this great change was effected. The vulgar were astonished at the sight of fire brought down from heaven, and philosophers themselves startled at the recollection that they had been amusing themselves with a *thunder-bolt* in their hands, and trifling with that terrible agent, which had so often alarmed and convulsed the physical world.

Dr. Franklin, suspecting that the *electric fluid* was similar to that which produced *lightning*, drew up a statement of the principal points in which these two agents resembled each other. He found that flashes of lightning, like the electric spark, are generally seen crooked and waving in the air;—that lightning, as well as electricity, strikes pointed objects in preference to all others;—that lightning and electricity take the readiest and the best conductors;—that they both dissolve metals and inflame combustible substances;—that they rend solid bodies, strike persons blind, reverse the poles of a magnet, and destroy animal life. These numerous points of resemblance appeared to Dr Franklin so very striking, that he resolved to examine, by direct experiment, the truth of his conjecture. For some time he waited for the erection of a spire in Philadelphia, to assist him in his views; but he afterwards thought of a more simple method of carrying them into effect.

Having extended a large silk handkerchief over two cross sticks, he formed a *kite*, which, unknown to any other person, except his son, he elevated during the first thunder-storm, which happened in the month of June 1752. The kite remained a considerable time in the atmosphere without any appearance of electricity. A cloud, which had the appearance of being charged with lightning, passed over it without producing any result, and Dr. Franklin began to despair of success. His attention, however, was suddenly roused by the erection of some loose fibres on the hempen cord; and upon holding his knuckles to a key which he had attached to the string, he received an *electric spark*. Before the rain had wetted the string, other sparks were obtained; but when the string was thoroughly wet, Dr. Franklin collected the electric fire in great abundance.

Before proceeding to his illustrative experiments, Mr. Lewthwaite introduced a forcible description of the appearance of the heavens during a *thunder-storm*. When

the sky is clear and serene, low and dense clouds begin to form in the atmosphere. They are spread over the heavens by a wind more or less violent, and are succeeded by others more thick and obscure. These clouds are agitated by various motions;—while some of them are moving above in one direction, others are moving in the contrary direction below them. One cloud is seen to attract another, while others are separated; and in the midst of this universal agitation, other clouds remain immoveable, in consequence of the opposing forces by which they are influenced. Amidst this conflict of opposite forces, flashes of blue light are seen to dart with inconceivable velocity from one cloud to another, and after the lapse of several seconds, the rumbling noise of distant thunder is faintly distinguished. The sky soon becomes more obscure, the lightning more frequent and vivid, and the thunder more loud, and succeeding the flashes of lightning at shorter intervals. A dreadful gloom is now spread over nature, and the sun almost seems to threaten the extinction of his feeble light. The husbandman retires from the field—the fisherman forsakes his nets—the birds of the air desert their native element—the brute creation run up and down in wild dismay, or seek for shelter from the impending danger—and the sky and the fields are thus left unpeopled during the dreadful strife of the elements. The storm is now at its height; the accumulated electricity of the clouds is seen to strike towards the earth, shivering the strongest oak in its passage. Surrounded with actual danger, MAN himself begins to participate in the general dread, and amidst this play of celestial artillery, he often feels for the first time the true rank which he holds in the great scale of Being. These tremendous phenomena often make the circuit of the whole horizon, and are frequently interrupted by heavy showers of rain or hail, till the atmosphere resumes its accustomed serenity. May we not, on contemplating such a scene of awful grandeur, exclaim with the poet,

"Lightnings and storms His mighty word obey,
"And planets roll where He has marked their way!"

Having mentioned that Dr. Franklin, in his important experiment, used a kite formed of a silk handkerchief stretched upon two cross sticks, Mr. Lewthwaite observed that an improvement had been made in the construction of electrical kites, by forming them of paper, and making them fold together, so that they may be put into a case, and carried through the streets without exciting the risibility of the spectators. Instead of a simple hempen cord, the string now employed has a fine copper wire woven in it, and to ensure the safety of the electrician, about ten or fifteen yards of silk cord is attached to the farther end of the string. [A kite of this kind, and a piece of the string furnished with copper wire were here exhibited to the audience.] Persons should be very careful in raising the kite, as there is some danger in elevating it, but none when it is raised. The string may then be fastened to a post, while the operator is at liberty to pursue his experiments at leisure. A jar, a stick of sealing wax, and a pith-ball electroscope are sufficient for ordinary purposes, but if the experiments are numerous, other apparatus will of course be necessary.

Mr. Lewthwaite introduced his experiments on *lightning conductors*, by observing that the members were by this time perfectly aware, that a *conductor* was a substance over which the electric fluid was capable of passing. One great evil in the conductors used in London for the purpose of protecting buildings from lightning is, that they are not of sufficient size. In the lecturer's own parish (Rotherhithe) the conductor attached to the church is of lead, only two inches wide, and if powerfully struck by lightning, would in all probability be melted. Another great fault is that the conductors do not communicate directly with the earth; as it is thought sufficient to connect them with the leaden spout or gutter, and as these do not always communicate with the earth; and the connection is very imperfect, the required protection is not afforded. At Islington Church, the conductor communicates, not with the earth, but with the roof of the building.

To shew the danger arising from the employment of *bad* or *imperfect conductors*, the lecturer placed upon the table a model of a house, to which was attached a *perfect conductor*. Two of the bricks were placed loosely in the wall of the little building, and upon passing the shock through the perfect conductor, no effect was produced. Mr. Lewthwaite then altered the arrangement of the apparatus, so as to interrupt the continuity of the conductor and render it imperfect, and upon again passing the shock through it, an explosion took place at the break, and one of the bricks was thrown from the building with considerable force. It was therefore evident that a bad or imperfect conductor was worse than none at all.

A model of a *powder magazine* was then exhibited, which was also furnished with an imperfect conductor, through which the shock of the jar was passed, when the gunpowder instantly exploded, and the model

was blown to pieces. The experiment was repeated with the same success with a second model.

The lecturer then constructed a *pyramid*, through which passed an imperfect conductor. The corners of the pyramid rested upon two pieces of glass tube, with brass wires passing through them; and when the shock from the jar, which was supposed to represent the discharge of an electric cloud passing over the pyramid, was communicated to the conductor, the glass tubes were broken, and the pyramid was overthrown.

Instances have frequently occurred in which houses have been struck and set on fire by lightning. A few years since, a house in Whitechapel was destroyed in this manner, the electric fluid having penetrated the roof and floors, and scattered the burning rafters and other materials in every direction. To exemplify the manner in which this effect is produced, a very small model of a house was exhibited, and the shock communicated to it, when the combustible substances it contained were instantly ignited and the whole interior of the building appeared in a blaze, accompanied with a number of loud explosions. Mr. Lewthwaite explained the occurrence of these explosions, by stating that in order to give additional interest to the experiment, he had placed among the resin which was ignited in the building, a paper with some small portions of *fulminating silver*, which were successively exploded as the flame came in contact with them.

A great deal has been said on the subject of *conductors for shipping*; and in that valuable periodical, the MECHANICS' REGISTER, some comments had appeared on the conductor employed in the navy by Mr. Harris.* In the lecturer's own opinion, conductors for shipping were *worse than useless*, because they must necessarily be *broken* and *interrupted*. To shew the nature and construction of these conductors, he had borrowed one, which was now suspended across the lecture room for the inspection of the members. (This conductor consisted of a series of copper rods, about two feet in length, and not more than a quarter of an inch thick, connected together by rings passing through loops at their extremities.) Mr. Lewthwaite had no doubt that he himself could make this conductor *red hot*; and if he could produce this effect with the quantity of the electric fluid which he was enabled to bring into action, what must be the effect to which a conductor of this kind was exposed, when the atmosphere, perhaps for forty miles round, was charged with electricity? To shew the impropriety of having bad conductors for shipping, Mr. Lewthwaite placed on the table a small vessel, and passed the shock through the conductor, when the combustibles it contained were instantly ignited, and the sails were in flames.

Conductors, either for shipping or houses, should always terminate in *points*, and not in *knobs*. It was not his intention at present to speak of the nature or effects of points, but merely to state the fact. Some years ago, the question of their comparative merits was the subject of much discussion, and was argued before the Royal Society, when their decision was in favour of *points*.

It has been suggested, that the reason why there is more lightning in summer than in winter, and at the Torrid than at the Frigid Zone, is because the electricity of the earth is taken up by *evaporation*. The lecturer regretted, however, that no experiments hitherto performed had decidedly shewn that *evaporation* produces signs of electricity. In a former lecture, he had shewn that *chemical action* was capable of producing this effect; and though by placing a piece of *red-hot iron* upon the cap of the electroscope, and pouring water upon it, the leaves are made to diverge, it must be recollected that *chemical action* accompanies this experiment; as the *oxygen* of the water unites with the *iron*, and forms *oxide of iron*, while the *hydrogen* is liberated. Mr. Lewthwaite performed this experiment successfully, but repeated his remark, that it was not of a decisive nature as to the production of electricity by *evaporation*, because the generation of *steam* was accompanied by the *chemical decomposition* of the *water*.

Mr. Lewthwaite here exhibited two objects which he had preserved, in consequence of their connection with the fatal effects of lightning on shipping. The first was a piece of the mast of a ship which was struck with lightning at Gravesend, and it bore evident marks of having been burnt and scorched in several parts. The other relic had, perhaps, excited the curiosity of the members from its extraordinary appearance. It was the shattered remains of a tarred cap or hat,* worn by an unfortunate seaman on board a timber vessel, which was struck by lightning in the channel. The lightning struck downwards through the deck, but as the timber with which it was loaded was a bad conductor, it did not pass directly through the vessel, but proceeded between the decks, and then forced its way upwards, and went off. In the space through which the fluid

* Vide vol. 1, p. 77.

passed between the decks, the unfortunate wearer of the cap was situated, and his life was instantly sacrificed to the destructive power of the lightning. No marks appeared upon his body, but his cap was torn asunder, as it now appeared to the audience, and the lecturer had since preserved it as a memorial of the direful effects of this terrible agent.

Water spouts are supposed to be occasioned by electricity. Mr. Lewthwaite elucidated the extraordinary nature of this phenomenon by displaying to the members an original drawing, taken by a gentleman who witnessed a water spout at Margate. The agitated appearance of the sea, and the ascent of a large column of water to the clouds were extremely well represented, and the lecturer observed that in cases of this kind, the clouds were supposed to be in a *positive*, and the earth in a *negative* state of electricity. The contrary might possibly be the case, and it was to be regretted that many opportunities of ascertaining more correctly the nature of this phenomenon were lost, in consequence of our mariners not being scientific men.

Many writers have imagined that *earthquakes* are occasioned by electricity. The lecturer was not disposed to adopt this opinion; but he performed an experiment to illustrate the manner in which it was supposed that the agency of the electric fluid might produce this effect. He took a long piece of wood, upon which a piece of tin foil, broken in three or four places, was extended, and at each of the places where the continuity of the conducting substance was interrupted, a piece of paper cut in the form of a house was placed. The shock was then communicated to the tinfoil, and the paper houses were instantly overturned. If the tin foil was supposed to represent the earth, and the pieces of paper cities upon its surface, an idea might be formed of the presumed effect of electricity in producing earthquakes.

Lightning assumes two appearances; one of which is the *zigzag* or *forked lightning*, and the other the *sheet* or *harmless lightning*. Under favourable circumstances, the electrical machine is capable of giving a tolerable correct representation of forked lightning. The lecture room being darkened, Mr. Lewthwaite succeeded in drawing from the conductor a spark about eight inches in length, which exhibited in a very satisfactory manner, the crooked and tortuous form of forked lightning; and he then proceeded to perform a very interesting experiment, for the purpose of shewing that *sheet lightning* is exactly the same as *forked lightning*, but that as the flash occurs at a greater elevation, it puts on a different appearance, in consequence of its being seen through the medium of the intervening clouds. A large plate of glass, on which was painted a representation of a mass of clouds, was exhibited to the audience, and the electric spark was repeatedly communicated to it by means of a sheet of tin foil placed behind it. At every shock, a broad sheet of vivid light extended itself over the surface of the painted glass, and presented a striking imitation of a brilliant flash of sheet lightning.

The next experiment was illustrative of the *Aurora Borealis*, or northern lights, which were also supposed to be occasioned by electricity, acting at a great elevation, and passing through an extremely rare medium. Three glass vessels, one of which was nearly three feet long, were successively exhausted of air, and the electric fluid being passed through the *vacuum*, assumed an extremely beautiful appearance. Innumerable coruscations of vivid light flashed through the tubes, and conveyed a forcible idea of the splendid phenomenon they were intended to illustrate.

Another atmospherical phenomenon, viz. *shooting* or *falling stars*, was then imitated with great correctness by passing the spark through an exhausted glass tube, and the lecturer observed that he considered these experiments as decisive proofs that electricity is *material*; for if it was merely a *property of matter*, it must have matter to work upon; but in the instances just witnessed, its effects were seen in a vacuum, where no matter was subjected to its operation.

With respect to the violent *rains* which usually accompany thunder and lightning, they have been attributed to the explosion of large quantities of *oxygen* and *hydrogen* in the atmosphere. The lecturer had shewn, in a former lecture, that *water* is formed by igniting these two gases by means of the electric spark; and he now read an interesting extract on this subject from Dr. Olinthus Gregory's Notes to his Translation of M. Haüy's Elementary Treatise on Natural Philosophy. The Doctor observes, that one of the most successful explorers of this region of physics was M. Libes, who is of opinion that the phenomena of the thunder, the lightning, and the rain of storms, are occasioned by the combined influence of *hydrogen, oxygen*, and the *electric spark*. The rain which is formed at the moment when the lightning traverses the air, can only arise from two causes: either from the sudden precipitation of the water which was dispersed in the atmosphere, or from a combination of the oxygen and hydrogen gas

occasioned by the electric spark. Libes considers these two effects separately. The rain of a storm, he remarks, frequently takes place without there having been previously any cloud to disturb the tranquillity of the atmosphere; yet it cannot be supposed that the water, which is in a very small quantity, and perfectly dissolved in the air, can be so precipitated at once as to form an abundant rain. Hence he recurs, on the contrary, to the electric spark, which in its passage, effected with inconceivable rapidity, meets with mixtures of oxygen and hydrogen gas, the combination of whose bases becomes affected, and gives birth to violent explosions, as well as to a quantity of rain proportional to the quantity of aeriform fluids that have served to produce the shower.

Mr. Lewthwaite's concluding experiment afforded a powerful illustration of the violent explosion occasioned by igniting a mixture of *oxygen* and *hydrogen*. A large bladder, containing about four gallons of the mixed gases, was attached to the ceiling of the lecture room, and a communication being formed by wires extending from the machine to the bladder, the spark was passed, when the gases exploded with tremendous violence, and not a vestige of the bladder remained. The report was absolutely deafening, and its effect upon the auricular organs lasted a considerable time.

Mr. Lewthwaite then observed, that as the Quarterly General Meeting of the Members would take place on the following Wednesday, his concluding lecture would be delivered on Wednesday, the 8th of June, when he should direct the attention of his hearers to the excitation of magnetism by means of electricity—the application of electricity to medical purposes—and the influence of points.

MR. WALLIS'S

FIRST LECTURE ON ASTRONOMY.

INTRODUCTORY REMARKS — GLOBULAR FIGURE OF THE EARTH—ITS REVOLUTION ON ITS AXIS—EFFECTS OF THE CENTRIFUGAL FORCE—MOTION OF THE EARTH ROUND THE SUN—VICISSITUDES OF THE SEASONS—LENGTH OF DAYS AND NIGHTS, &c.

FRIDAY, 27th MAY.

From the account which we had previously heard of Mr. WALLIS's abilities as a lecturer, and the splendid apparatus by which he illustrated the sublime science of ASTRONOMY, our expectations were excited in no ordinary degree upon the present occasion; and we are happy to add, that the anticipations in which we had ventured to indulge, were amply fulfilled. The extensive mechanical apparatus employed by the lecturer occupied a considerable portion of the lecture room, and was temporarily concealed from the view of the audience by curtains extending nearly the whole breadth between the galleries. The lecture table was placed in the front of the curtain in the centre, and the entrance of Mr. WALLIS, accompanied by Dr. BIRKBECK, who presided during the evening, was hailed with the acclamations of as crowded an assemblage of the members as we have ever witnessed.

Mr. WALLIS commenced by observing that the science of ASTRONOMY was that which communicated a knowledge of the heavenly bodies; which ascertained their distances and magnitudes; explained their varied appearances; and elucidated their unerring motions. While astronomy is classed among those sciences which are comprehended under the general head of natural philosophy, it is distinguished from other sciences, in consequence of its not being susceptible of demonstration by experiment; for experiment can only illustrate, without demonstrating the various facts referred to. When the chemist performs an experiment, he is enabled to avail himself of the actual elements whose various combinations put him in possession of certain facts, while the astronomer can only reason by analogy, and establish his theory on the basis of inference. Astronomy, therefore, is only hypothetical, and consequently involves a greater exercise of the imagination than any other branch of natural philosophy. Another difficulty attendant on this science is, that the facts it teaches seem at variance with the dictates of the senses, particularly that of vision. If we look at the moon, it presents a flat surfaces to the eye— but when other circumstances are considered, we are led to believe it spherical. From its great distance, the rays of light proceeding from it, fall upon the eyes in lines which are parallel, or nearly so, and there is not that distinction of light and shade which, in viewing a globe at a short distance, impresses a belief that it is spherical. If, however, we watch the various phases of the moon, we witness its regular gradations from a circular to an oval form, and from that to the half-moon* and the crescent, till it entirely disappears; and all these changes are only explicable upon the supposition that it is globular, and receives its light from the sun. Astronomy is therefore, strictly speaking, a branch of natural science, because the truths it in-

culcates remain uncontradicted by fact, and this is all that can be required or expected.

Mr. Wallis then observed that his present lecture would be devoted to an illustration of the phenomena of our *earth*, which, if he might so express himself, was one of the *celestial bodies*. He would first consider its *figure*, which, by analogy, he was led to believe was similar to that of other planets, because the circumstances connected with it were such as could not be accounted for upon any other supposition. The reason why we are disposed to consider the earth flat, is because we can see but a small portion of its surface at one time. If we look at a globe like that which is on the lecture table, we can at once see its curvature; but if its diameter be extended to 8000 miles, the curvature of as much of its surface as can be seen at once will be so small as to become imperceptible. Another reason why the earth appears flat is because we are situated upon its surface and agreeable to the laws of perspective, the most distant objects appear to occupy the highest situation. If we are placed where we can command an extended view of the sea, instead of distinguishing the curvilinear form of its surface, it appears to rise before us like an immense hill; and this deception is owing to the great distance to which our sight is carried, without any thing to interrupt the distant field of view. We cannot, therefore, by the assistance of vision alone, arrive at the true figure of a spherical body, if we are upon its surface; for the most distant part will seem to be higher than that upon which we stand, though we know it must be lower. Its figure must then be deduced from other facts. If we observe a star exactly over our heads at London, it will not appear in the zenith of a spectator situated 60 miles to the south, as at Brighton. This could not be the case if the earth were a flat surface, for such is the immense distance of the fixed stars, that on a perfect plane, there would be no sensible difference in their apparent situation, to observers placed at the distance of a hundred million of miles from each other.

In the science of astronomy, it is difficult to preserve a perfect arrangement of facts which are so blended with each other, that to illustrate one part of the subject, it is necessary to introduce other parts with which it is connected. If the earth revolves on its centre, its figure must be somewhat globular. By observations upon the motion of spots upon the surfaces of other planets, it is found that they all revolve on their axes, and by analogy we are led to conclude that the earth revolves in a similar manner. It is evident either that the earth revolves on its axis once in every 24 hours, or that all the heavenly bodies revolve round the earth in the same time, and there are incontrovertible reasons for adopting the former opinion. Motion is only a relative idea. Thus if we take two balls, and cause one to revolve round the other, the effect is exactly the same, whether the smaller ball moves round the larger, or the latter round the former. The lecturer shewed this to be the case, by moving two balls in the manner described, and proceeded to observe, that if it could be shewn that the motion of the earth on its axis was the more probable, we had a right to conclude that such is its actual motion. There are in the heavens many millions of fixed stars, placed at inconceivable distances from us and from each other, and either the earth which we inhabit must revolve in its axis, or all these innumerable bodies must revolve round us. The simplicity of the former motion affords powerful evidence of its existence; and this is further confirmed by the fact that the other planets are known to revolve on their axes. Besides this it must be considered that the sun, in order to revolve round the earth in 24 hours, must move at the rate of 400,000 miles in a minute of time, and the fixed stars at an infinitely more rapid rate. All the stars must, upon this supposition, be kept in one vast and tremendous whirl; the whole of which is at once got rid of, by supposing the earth to revolve upon its axis every 24 hours, with a soft, gentle, and insensible motion.

But if the earth revolves on its axis, we can no longer consider it *perfectly globular*. There is no substance within the compass of our knowledge that is perfectly *inelastic*. *Lead* is the least elastic; yet if two pieces of this metal strike against each other they will rebound. The earth is principally composed of *granite*, a substance much more elastic than *lead*, which is evident from its ready conveyance of sound. The earth is therefore an elastic body, and elastic bodies in rapid revolution cannot retain the same form as when at rest. To illustrate this remark, the lecturer exhibited two circular hoops, crossing each other at right angles, and observed that the audience might imagine the sphere to be completed by a series of such hoops. He then spun the apparatus, when it was seen that the hoops no longer preserved their circular form, but became considerably depressed at the points on which they revolved, and the axis was consequently shortened. This effect is readily explained by the *centrifu-*

gal force, which causes a stone, whirled round in a sling, to fly off when set at liberty, in a line which is a tangent to the curve described by the stone. Now as all the parts of the earth's surface revolve on its axis in equal times, it is evident that those parts which are farthest from the poles, having the greatest space to pass through in the same time, must revolve with the greatest rapidity, and possess the greatest *centrifugal force*. Hence it has been found by actual measurement, that the diameter of the earth at its axis is 36 miles less than the diameter of the equator. A striking fact in confirmation of the effect of the centrifugal force is found in the planet Jupiter, which is the largest in the system, but performs its diurnal revolution on its axis in the short space of 9 hours and 56 minutes. As its motion is therefore much more rapid than that of the earth, the centrifugal force acts with greater power, and the difference between its polar and equatorial diameters, is much greater. The same remark applies to the planet Saturn, which revolves on its axis in 10 hours and 16 minutes, though it is a thousand times as large as the earth. Mr. Wallis exhibited two large transparent diagrams to shew the figure of these two planets. In the centre of each of these diagrams a black circle was drawn, and the actual figure of the planet was shewn by a luminous ring on the exterior edge of the circle, increasing in breadth as it receded from the poles, so as to exhibit a considerable difference between the two diameters.

Having already stated that the polar diameter of the earth had been ascertained by actual measurement to be shorter than the other, he would now endeavour to prove, by mechanical means, that it is impossible for a body to revolve on any other than its shortest axis. A body of an oval form, or of any figure with two unequal diameters, must revolve on the shortest of the two. Mr. Wallis here exhibited an elastic globe, supposed to represent the earth, though its proportions were exaggerated to illustrate the subject more clearly. He spun it rapidly upon its axis, which was its *longest diameter*, but the effect of the centrifugal force in a few moments changed its figure, which became protuberant at the equator, while the length of the diameter at its axis was proportionably shortened.

These principles were still more strikingly exemplified, by means of a very ingenious piece of mechanism, bearing some resemblance to a crane. To the front of this apparatus a wheel was fixed, the revolution of which, in a *vertical direction*, communicated a *horizontal revolution* to any substance suspended from the extremity of the projecting arm. To this arm a piece of wood of a circular form was suspended by its edge, and when first put in motion, it revolved, for a few seconds in that direction, but was almost immediately seen in rapid revolution *horizontally*.—A steel chain, joined at its extremities, was then attached to the apparatus, and after a few vertical revolutions, its direction was completely changed, and it revolved horizontally in the form of a ring. If it be said, that there does not exist in nature a figure similar to that exhibited in the experiment, he would reply, that such a figure does exist in the planet Saturn; and that there is not, in the whole range of nature, so magnificent an instance of the mechanical effect of centrifugal force. It is found that the outer edge of the ring of Saturn revolves with a velocity of 90,000 feet in a second of time, and he would shew that the position it assumes is such as must necessarily result from the centrifugal force. An ivory model of the planet was then suspended to the apparatus by the edge of its ring; but it quitted this position when it began to revolve, and soon turned with great velocity upon its shorter axis. A very *oblate spheroid*, about a foot in diameter, which was an exaggerated imitation of the form of the earth, was finally suspended by its equatorial diameter, and notwithstanding its weight was considerably greater than that of the substances previously employed, it obeyed the impulse communicated to it, and in a few seconds revolved rapidly on its *polar* or *shorter axis*. From this accumulation of facts, we are warranted in concluding that our earth revolves on its axis from west to east; giving to the heavenly bodies an apparent revolution from east to west. For the original principle of this machine, the lecturer acknowledged himself indebted to kindness of his friend Dr. Olinthus Gregory.

Besides the apparent diurnal motion of the heavenly bodies from east to west, as the sun, in the course of 365 days, appears to travel through the whole circle of the heavens, it might be inferred that either the sun or the stars must move; but this appearance may be as easily explained by the motion of the earth round the sun, as by that of the sun round the earth. He should endeavour in the course of the lecture, to establish the fact of the earth's revolution round the sun, by demonstrating that from the operation of mechanical causes, upon no conceivable principle can we make a *heavier* body revolve round a *lighter*.

Mr. Wallis then gave a familiar illustration of the nature of *centrifugal force*, by means of two glass tubes, slightly inclined with the horizon, each containing three different substances, viz.,—leaden shot, coloured water, and common air, arranged according to their specific gravities; the shot occupying the lower, and the air the upper parts of the tubes. They were then attached to a whirling table and were made to revolve with rapidity, when the order of gravitation was completely reversed; the shot, from its greater momentum, flying to the top of each tube, the water occupying the middle, and the air the bottom.

Now it must be evident, if we consider the nature of the *centrifugal force*; that as different parts of the earth's surface revolve with different degrees of velocity, its effect must vary in proportion to the distance of any part from the poles. If this be the case, the *weight of bodies* must also be different in different latitudes. Supposing, for instance, that a mass of lead at the poles possesses a definite weight, the same mass will not be so heavy at the equator, because in the equatorial regions the centrifugal force is the greatest, and bodies therefore have the greatest tendency to fly off. Gravity is a force which acts over the whole surface of the globe *equally*, and if this force is opposed by another which acts *unequally*, the weight of bodies must necessarily differ in different parts of the surface. But here the question naturally occurs, how can this fact be ascertained? for if a pound of lead is equipoised by a pound weight at the poles, they will still balance each other at the equator, because the weight will become lighter as well as the lead. This however can be ascertained by means of the *pendulum*, which by the force of gravitation, has a tendency to fall towards the earth. If, however, its weight at the equator is less than at the poles, it will not fall so quick, and consequently the pendulum will not swing so fast. The attraction of gravitation is opposed by another force, and this is one of the strongest proofs of the revolution of the earth upon its axis.

The next point to which Mr. Wallis directed the attention of his audience, was the impossibility, upon mechanical principles, of making a *heavier* body revolve round a *lighter*. But as this subject has been so recently adverted to in our pages by Mr. Wallis, in his able and argumentative reply to Asteroid,* it is unnecessary to repeat the illustration in this place.

Mr. Wallis then proceeded to elucidate the phenomena of the seasons, and the variable length of the days and nights through the year, in consequence of the earth's axis of revolution being inclined to the plane of its orbit in an angle of about 23½ degrees. The lecturer first made use of a small globe, upon which the light of a lamp, representing the sun, was thrown. By inclining the axis of this globe to the plane of the horizontal tellurion, he succeeded in shewing the situation of the earth with respect to the sun, in four different parts of its orbit. It was distinctly seen that at the vernal and autumnal equinoxes, in March and September, the *terminator* or *boundary line* which divides the dark from the enlightened half of the earth, passes through the poles, so that the days and nights are of equal length in every part of the globe; but that in June and December, the periods of the summer and winter solstices, the days and nights are necessarily unequal. As the vertical tellurion which he was about to exhibit, was better adapted to the illustration of this subject, Mr. Wallis withdrew for a few moments, to prepare the transparent scenery connected with his admirable apparatus.

The lecture-room was then darkened, and the central curtain being drawn up, exhibited to the audience a brilliant transparency of the earth, about four feet in diameter, upon which the vast continent of America was correctly delineated. At the top of the lucid ring which surrounded this globe, a mountain was depicted, and a small ship appeared upon another part of the earth's surface. This vessel was put in motion by means of the internal machinery, and its gradual motion, as it approached the mountain, and after passing it, sank below the horizon as it receded from it, enabled Mr. Wallis to explain, in a very satisfactory and perspicuous manner, the rotundity of the earth, which was represented in the diagram as it would appear to a spectator placed at a distance of many thousands of miles from its surface. Mr. Wallis also added a series of interesting remarks to those which he had made in the former part of his lecture, on the weight of bodies, the attraction of gravitation, the centrifugal force, &c. The earth, he observed, consisting of an immense number of particles, the greatest attraction must be in the direction of the greatest number of these particles; or in other words, as a diameter of the earth, or a right line drawn through its centre, is the longest, all bodies on its surface must be attracted towards the centre. At the centre of the earth a body possesses no weight,

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* Vide Asteroid's letter, vol. 1, page 412; and Mr. Wallis's answer, vol. 2, page 45.

because it is attracted equally in every direction; and if it were possible to bore a tunnel completely through the earth, a cannon-ball dropt into it, would not pass through, but being carried by its momentum nearly to the opposite surface, would return, and again passing the centre, would continue to vibrate backwards and forwards, till it ultimately remained immoveable at the centre Mr. Wallis here observed that the attraction of the earth is the cause of weight in bodies on its surface, but that it has no weight in itself. For his illustration of this remark, we beg again to refer our readers to his letter at page 47 of the present volume.

Mr. Wallis again withdrew for a minute or two, to prepare other transparencies, and on his return, four different views of the globe, upon the same extended scale, were successively exhibited, as a further illustration of the vicissitudes of the seasons, and the length of the days and nights. The first of these represented the northern hemisphere, as seen from an immense distance on the 21st of June. The lower part was enveloped in shadow, of which the boundary line passed about 23½ degrees below the centre, or North Pole, so that the greater part of the surface was illuminated. Mr. Wallis pointed out the situation of Great Britain, just emerging from the shadow at the period of sun-rise, and as the globe slowly revolved on its axis or centre, he traced its progress till it sunk into the shadow at sunset on the opposite side, and again emerged from the darkness on the following morning. By this striking and beautiful illustration, it was distinctly seen, that on the longest day this country is illuminated by the beams of the sun during a period of 17 hours, and is only involved in shadow during the remaining seven.

The other three transparencies exhibited the appearance of the earth on the 21st of March and 23d of September, or the vernal and autumnal equinoxes, when the terminator passes exactly through the poles, and the days and nights are equal on every part of the globe; and also on the 21st of December, when the opposite effect to that exhibited at first takes place, and the day is the shortest, while the night is extended to 17 hours.

The concluding scene displayed by Mr. Wallis was of the most magnificent and splendid description, and elicited reiterated and enthusiastic cheers from the delighted audience. It represented on a large scale, the twelve signs of the zodiac, brilliantly illuminated, with the sun in the centre, to whose rays a rapid motion was communicated by mechanical means, which gave it the appearance of a globe of living fire. Within the zodiacal circle, the earth was seen revolving on its axis, and travelling gradually through its orbit, so as to exhibit at one view a perfect illustration of the various changes of the seasons, and the progressive increase and decrease in the length of the days and nights during its annual journey through the regions of infinite space. As it travelled through the whole of the circle, Mr. Wallis accompanied its progress with his able remarks, and pointed out to the audience the various signs of the zodiac in which the sun is successively seen in the course of the year, in consequence of being viewed from different parts of the vast orbit of the earth; and as, during the revolution of the latter, a part of its surface was continually involved in shade, the gradual augmentation and diminution of the illuminated portion enabled the lecturer to illustrate, in a forcible manner, all the varieties of the seasons, and the different lengths of the days and nights, which necessarily result from the obliquity of the earth's axis to the plane of the orbit in which it revolves.

Mr. Wallis also introduced some appropriate observations on the complicated subject of the *Calendar*, and concluded his admirable lecture by stating, that on the following Friday he should devote his attention to an illustration of the phenomena of the moon.

LECTURES FOR NEXT WEEK.

On Wednesday, June 8. Mr. LEWTHWAITE's Eighth and concluding Lecture on Electricity.

Friday, June 10. Mr. WALLIS's Third Lecture on Astronomy.

SIXTH QUARTERLY GENERAL MEETING

OF THE

Members of the London Mechanics' Institution.

On Wednesday evening last, the Sixth Quarterly General Meeting of the Members of the Institution was held at the Lecture Room in Monkwell Street, when the lively interest taken in its proceedings was evinced by a very numerous attendance.

At eight o'clock, Dr. BIRKBECK, the President of the Institution, took the Chair, and after adverting in a few words to the purposes for which the Meeting was assembled, agreeable to the rules, observed, that as the Secretary was busily engaged at the present time in receiving the subscriptions of the Members, the Minutes

of the last Meeting, and the Quarterly Report, would be read by the late Honorary Secretary, Mr. Blake. At the future Meetings of the Society, the Secretary would not be prevented from attending to the ordinary business of the evening.

The Minutes of the Quarterly General Meeting held on Wednesday, the 2nd day of March last, were then read and confirmed unanimously, after which Mr. BLAKE read the following ample and gratifying Report, which was received with the most cordial expressions of satisfaction by the Members.

SIXTH QUARTERLY REPORT

Committee of Managers of the London Mechanics Institution.

On no previous occasion have your Committee experienced greater pleasure than they now experience in submitting to the Members the Sixth Quarterly Report of the proceedings of this Institution.—Finding that their most sanguine hopes are about to be realized—and that every object connected with this undertaking affords, by its present favourable aspect, matter of congratulation, they feel certain that all who have its interest at heart, and therefore must rejoice in its progress, will equally with themselves, derive the highest satisfaction, from knowing, that its existence and its contemplated advantages are now completely secured. Your Committee will not dwell upon the splendid advantages which this Institution holds out to the present and rising generation—Experience, they trust, has already taught you duly to estimate its extraordinary merits, and attached you to those operations which combine in so eminent a degree, practical utility with intellectual gratification. The aspiring mind here finds its thirst for knowledge satisfied—latent talent is developed—every mental energy is roused into action, and new motives are implanted, by which future human existence is made to display a character and a power, hitherto, unless in a few solitary examples, unknown. Before entering into a more minute detail, the Committee beg to call your attention generally to the flourishing condition of the Institution; to the great increase of members, and the encouraging state of its financial concerns; to the liberal donations in money and in books; to the assistance of able and enlightened lecturers; to the extensive patronage of men of rank and talent; and above all, to the decided co-operation of the members themselves. Your Committee, indeed, deem it one of the most prominent objects of their success, to have received such ample support and assistance from the constituent body of the Institution. This is, unquestionably, conclusive proof, that the beneficial influence of the society has already been extensively felt. Without the hearty co-operation of the Members, the labours of the Committee must necessarily have been vain;—they therefore fully appreciate the support which they have derived from your exertions, and they can assure you that this will become an additional encouragement to devote their time and attention to forward the best interests of this flourishing Society.

The report then proceeded to particularise the receipts and disbursements of the last quarter, and presented to the members such ample evidence of the prosperity of the institution, as afforded the most lively satisfaction to the meeting. It appeared from the financial statement, that the balance in the hands of the bankers at the close of the preceding quarter was £607. 16s. 8d.; that since that period the sum of £1486. 16s. 4d. had been received; that the disbursements amounted to £586. 17s. 1d.; and that at the close of the quarter's accounts the sum of £1507. 15s. 11d. remained in the bankers' hands. Of the total amount received, £1135. 0s. 0d. consisted of donations, and £321. 14s. 0d. of members' subscriptions. Among the items of expenditure, which were detailed with great minuteness, we were happy to observe that the debt of £200. for the fixtures on the premises in Southampton Buildings had been discharged, and that more than a hundred guineas had been disbursed for the purchase of additional books for the library.

Your Committee have now to exhibit a splendid list of donations, and to express their grateful acknowledgements to the donors.

MONEY

Received since the last Quarterly Meeting.

	£.	s.	d.
W. Jones, Esq.,	20	0	0
Joseph Woods, Esq.	5	0	0
Richard Parker, Esq.	20	0	0
William Wilberforce, Esq.	10	0	0
Mr. Alderman Wood	10	0	0
Michael Hoy, Esq.	20	0	0
John Geo. Lambton, Esq. M.P.	50	0	0
Sir Francis Burdett, Bart. (in addition to his former donation of £100.)	1000	0	0
Total £	1135	0	0

BOOKS

Received during the past Quarter.

Young's Treatise of Algebra . . 1
Presented by Mr. Young.

Technical Repository, in numbers, as published, 6 numbers.
Presented by the Editor, Mr. Gill.

London Journal of Arts and Sciences, in numbers, as published, 3.
Presented by the Proprietor, Mr. Newton.

St. Pierre's Studies of Nature . . 4
Presented by Mr. Read, 11, Upper Brook Street, Grosvenor Square.

Bird's Astronomy 1
Presented by Mr. J. H. Marshall.

Transactions of the Geological Society 2
Presented by Mr. B. Bevan.

Dunn on the Spheres, 1, Priestley's Introduction to Electricity, 1, Riley's Arithmetical Tables, 1, Baker's Equations, 1, Oughtud's Calculations, 1, Sydenham's Works, 1, Rathbone's Surveyor, 1, Mead on the Plague, 1, Ditto on Poisons, 1, The Art of Shadows, 1, Epictetus' Morals, 1, Percival's Medical Essays, 2, Haudley on the Animal Economy, 1, Shebbeare's Physic, 2, Macquer's Chemistry, 2, Plans and Elevations of Houghton Hall, 1, Shaw's Physic, 2, Morris Birkbeck's Notes on a Journey to America, . . . 22
Presented by Mr. Peter Thompson.

Gibb's Architecture, 1, Evelyn's ditto, 1, Langley's ditto, 1, Le Clerc's ditto, 1, Palladio's ditto, 1, Morris's ditto, 1, Letter to the Livery of London, by Sir Richard Phillips, 1, 7
Presented by Mr. Taine.

Account of the Rye House Plot, 1, Boileau's Political Economy, 1, De Lolme on the English Constitution, 1, Debates on Mr. Wardle's Charges against the Duke of York, 1 . . 4
Presented by Mr. Cope.

Lord Pigot's Account of the Revolution at Madras, 1, Savage's History of Germany, 1, Kearsley's Peerage, 2, Sheldrake on Wheels, 1, Universal Gazetteer, 1, the Oxford Guide, 1, Moore's Marriage Ceremonies, 1, Review of the Colonial Registration Act, 1, Origin of the Agricultural Associations in Great Britain, 1, the Amusing Chronicle, 2, and a variety of small pamphlets, &c. 12
Presented by Mr. Harry Banks.

Young's Syllabus of Lectures, on Natural and Experimental Philosophy 1
Presented by Mr. Hauley.

Bellidor's Architecture Hydraulique, 4, La Science des Ingenieurs, 1, Emerson's Miscellanies, 1, Ditto Fluxions, 1, Ditto Algebra, 1, Ditto Optics and Perspective, 1 - - 9
Presented by Joseph Woods, Esq.

Delile's L'Arithmetique, 1, Echard's Gazetteer, 1 2
Presented by Mr. Edmonds.

Smith's Wealth of Nations . . 3
Presented by Mr. Tijou.

Tatham's Architectural Ornaments, 8 parts.
Presented by Messrs. Priestly and Weale.

Harris's Algebra, 1, Cunn's Sector, 1 2
Presented by Mr. Stuchbury.

Francœu's Lineal Drawing, 13 copies 13
Presented by Miss Mallett.

Cæsar's Wars in Gaul, 1, Voltaire's Charles 12th, 2, Æsop's Fables, 2, Congreve on the Steam Engine, 1, Elmes on the Law of Delapidations, 1, Bloomfield's Rural Tales, 1 . 7
Presented by Mr. G. Morland, of Nettleshed.

Pierre Richelet s French Dictionary . 1
Presented by Mr. Fowler.

Verulamianu, by Lord Bacon, 1, Utopia, by Sir Thomas More, 1, The Pleader's Guide, a Poem, 1, . 3
Presented by Master G. Sweet.

Locke on the Understanding, 1, De Lolme on the English Constitution, 1 2
Presented by Mr. W. D. Saul.

Two Plays 2
Presented by G. P. Eckstein.

Fosbroke's Encyclopædia of Antiquities 1

Mechanics' Register, (weekly),
Presented by Messrs. Cowie and Strange.

Spurzheim's Principles of Educations 1
Presented by Mr. N. Adams.

Military Manœuvres of his Majesty's Infantry 1
Presented by Mr. James Hunter.

Parke's Chemical Essays, 2, Ditto ditto Catechism, 1, Ditto on the Repeal of the Salt Laws, 1, Ditto Letter to Farmers, &c. on the use of Salt in Agriculture, 1 . .
Presented by the Author.

Tracts designed to inculcate Moral Conduct on Christian Principles . 5
Presented by the Christian Tract Society.

Noble on the Plenary Inspiration of the Scriptures 1
Presented by Mr. Darwin.

Thompson's Lunar and Horary Tables 1
Presented by the Author.

Popular Encyclopædia, 3 parts, 2 copies, 6.
Presented by Mr. Hetherington.

Joyce's Practical Chemical Mineralogy, 1, Last Day by Lord Byron, 1, Wood on Rail Roads, 1, Mechanics' Library, (4 parts) 1, Mechanics' Magazine, vol. 3, 1, Jamieson's Modern Geography, (6 parts) 1, Nicholson's Operative Mechanic, 1
Presented by Messrs. Knight and Lacey.

Critical Gazette, 12 numbers . .
Presented by Mr. St. Leger.

Dugdale's British Traveller, 1st volume, 1, Nugent's French and English Pocket Dictionary, 1 . .
Presented by Mr. G. Morley.

Captain Basil Hall's notes on South America, 2, Ditto ditto ditto Voyage to Loo-Choo, 1, Sir James Hall's Essays on Gothic Architecture .
Presented by Captain B. Hall, of Edinburgh.

Emerson's Mechanics, 1, Bland's Geometrical Problems, Leslie's 1, Elements of Natural Philosophy, 1, Observations on the Four Gospels, 1
Presented by Mr. Webb, Clifford's Inn.

	131
9 numbers and 14 parts equal to	3
Total Volumes	134

The expences incurred in building the new Lecture Room are separated from the current disbursements of the Institution, and will, the work being completed, be laid before the members at their next Quarterly Meeting; but your Committee deem it necessary in the mean time to inform you that £2,000. have been borrowed of your excellent President, on very favourable terms for that purpose, and that they are now in a condition to finish the work without the aid of further advances, it being decided that part of the large balance in the hands of the bankers should be appropriated to that purpose.

Great exertions have been made, and are still making, to complete the Lecture Room. The roof and stairs are finished, the frame-work and internal fittings are in a very forward state; so that, although your Committee regret much that they have been unable to finish it for the use of the present meeting, they anticipate the pleasure of seeing the members assembled in their own Theatre before the termination of this month.

Your Committee have next to report that 493 new members have enrolled themselves during the last quarter; that 254 have ceased to pay their subscriptions during the same period, and that the total number of members at present is 1,165.

Your Committee, anxious to carry into effect all the objects contemplated by the Institution, as speedily as circumstances will admit, have directed their attention to a most important feature—the establishment of a Circulating Library for the use of the members.

To carry into execution an object so desirable, your Committee have already purchased upwards of 900 volumes, and are still proceeding in making further purchases.

But considering the large number of members now belong to the Institution, and consequently the immense number of works which will be required for circulation, such a measure must commence on rather a limited scale. This the members must be well aware cannot be of very long continuance; for the sums set apart for the purchase of books when expended, and the liberal assistance by donations, not only by the members, but by other public-spirited individuals, must very soon produce a supply fully adequate to the demands both of the Reading Room and circulation.

The number of volumes presented to the Institution, from its commencement to the present period, amounts to 529, and the purchases already made exceed that number; for about 1429 volumes are at present to be found in your Library.

Your excellent philosophical apparatus, models, and minerals, have occupied a large portion of the time and attention of the Committee. About the commencement of the quarter, Mr. Bluett, whose care and attention, in preparing the various experiments for the lectures, both before and since his appointment, you have had many opportunities of witnessing, was engaged, at a salary of fifty guineas per annum, to keep in order this valuable part of your property.

The apparatus-keeper has been kindly assisted by Mr. Tatum in arranging the apparatus, and by Mr. Stetchbury in the classification of the minerals; considerable progress has been made in both these departments, and the whole will be ready to be laid open for the inspection of the members generally in a short time after the opening of the New Lecture Room. Your Committee have deemed it prudent not to open the Museum whilst it is necessary to remove portions of the apparatus from the premises, for the purpose of illustrating the lectures delivered in this place.

Your Committee feel that it would be depriving their Report of one of its most interesting features were they to omit the subject of the Elementary Schools.

Since they last had the pleasure of meeting you they have opened the Mathematical and Drawing Schools; and through the kindness of Mr. Jones, a member of the Institution, they have added a fourth class, for instruction in the French language.

The Mathematical School is conducted by Mr. Downes of Earl Street, Finsbury Square, who was appointed on the 7th of March last, at a salary of £20. per annum; and the Drawing School is under the direction of Mr. Davy, of Furnival's Inn, who was appointed on the 16th of May, with a salary of 30 guineas per annum.

Whether the Committee contemplate the increasing thirst for knowledge which pervades the different classes, the spirit of harmony which reigns among the members composing them, or the gratifying reports of their improvement from the several teachers, they see much reason to congratulate you on the rapid progress which has been made towards completing the objects of this Institution.

Your Committee with pleasure take this opportunity of testifying their warmest approbation of the labours of the different instructors, and sincerely hope that the good understanding which now prevails between the pupils and the teachers, will ever remain.

Without minutely adverting to the valuable courses of lectures which you have heard in this place during the last three months, your Committee feel anxious thus publicly to acknowledge their gratitude to your worthy President, for again unravelling to you the intricacies of a portion of science in his eloquent lectures, on voltaic-electricity, electro-magnetism, and thermo-electricity, as well as for translating and reading to you Dupin's admirable address to the mechanics of Paris; to Mr. Wheeler, for his perspicuous course of lectures on botany; to Mr. Lewthwaite for his extensive and interesting course of lectures on electricity; to Mr. Ogg for his instructive elucidations of the nature of heat, the effects of attraction, and the properties of common air; to Mr. Joplin for explaining his ingenious instrument for drawing curves, and exhibiting the beautiful specimens of its performance; and to Mr. Reynolds, whose pleasing lecture on the art of improving the memory cannot be forgotten. All these gentlemen have devoted their time and talents to your service gratuitously, and therefore have a double claim on your gratitude.

The subject which was referred to the Committee at the last Quarterly Meeting has received their attentive consideration, and they are of opinion that much good will result from the introduction of honorary members, and from the aid of distinguished foreigners as corresponding members: and they have determined to submit to you the following regulations for accomplishing this desirable object.

I. That any person having given to the institution a course of not less than six lectures, or a sum of ten pounds in money, or books, implements, specimens, models, or apparatus, to the value of fifteen pounds, shall be considered an honorary member, subject to all the present and future regulations observed by the members of the institution.

II. That the Committee shall be empowered to admit distinguished foreigners as honorary and corresponding members, without donations.

Having now overcome the various difficulties which naturally present themselves on the formation of so great an undertaking as the London Mechanics' Institution, and having found that an irresistible conviction of its utility now pervades the kingdom, so that other institutions of a similar nature are now looking up to it as the parent, and almost daily applying for information to enable them to follow our steps, ought we not still farther to promote its extension, in order that it may, at length, embrace those high pursuits which are calculated to enlarge the mind and benefit society.

This *can* be accomplished, and we may venture to assert, *will* be accomplished, if the same spirit of persevering activity which has hitherto manifested itself remains unabated; and if the members generally continue to join, as they have hitherto, their exertions to those of the Committee.

In conclusion, your Committee feel themselves bound to declare that the encouragement which they have received from your cordial co-operation has, in every instance, lightened their labours, and enabled them to carry into execution the various plans which have been suggested for promoting the general good.

The Committee will not detain the members longer by enlarging upon the great advantages which must result to every one connected with this Society. They are convinced that no arguments are necessary to induce you to keep its interests at all times steadily and zealously in view; for, unquestionably, in proportion to the constancy and energy with which these interests are promoted and maintained, will be the progress and prosperity of the London Mechanics' Institution.

Mr HODGSKIN observed, that after the unequivocal tokens of approbation with which the members had listened to the

Report, it was unnecessary for him to introduce a single remark in moving that the Report now read be received. This motion was duly seconded, and carried unanimously.

Dr. BIRKBECK then reminded the Meeting, that mention had been made in the Report of some communications of a very favourable nature having been received from the Preceptors in the Elementary Schools. The letters of these gentlemen were of so gratifying a nature, that the Committee conceived their contents would afford much satisfaction to the members at large, and had therefore recommended that they should be read to the Meeting.

The letters alluded to were accordingly read from Messrs. BLACK, DOWNES, and COLLINS, the Teachers in the French, Mathematical, and Arithmetical classes, and contained a very satisfactory account of the conduct and progress of the various pupils under their superintendence.

Dr. BIRKBECK called the attention of the Meeting to that part of the Report which related to the admission of honorary members. It would be recollected that at the last Quarterly Meeting this subject had been referred to the consideration of the Committee, who in compliance with the wish of the members, had submitted the two propositions embodied in the Report for their approbation. If, however, there were any of the members who did not see the propositions in the same point of view as the Committee, they were perfectly at liberty to state their objections.

Mr. TAYLOR enquired whether it was intended that honorary members should possess all the privileges of ordinary members.

Dr. BIRKBECK replied, that the character of an honorary member excluded him from all participation in the management of the affairs of the Institution. He would possess no part of the property of the Society, except its use:—he would not be entitled to the benefit of the Circulating Library, nor to vote at any of the meetings of the members.

After some further conversation, Mr. JONES, the proposer of the original resolution at the previous meeting, observed that though the Report had been unanimously received, it was necessary that the propositions should be specifically submitted to the members. He was aware that the attention of the Committee had been carefully directed to the subject, particularly to that part which related to the admission of distinguished foreigners as corresponding members, and he concluded by moving the first resolution.

The resolution was opposed by a MEMBER, who observed that in his opinion the effect of admitting honorary members would be to divide the Institution into two distinct classes. Their number would in all probability increase till they formed an influential body, and that identity of interest which now existed, in consequence of the principle of equality among the members, would be destroyed. The Institution had hitherto flourished without honorary members, and though it might appear ungracious to oppose a measure recommended by the Committee, he could not give his support to the proposed resolution.

Mr. TIJOU conceived that the last speaker had been building a long chain of reasoning on a fallacy. Excluded as the honorary members would be from all influence in the management of the Society's affairs, and from all privileges, except those of attending the Library or the Lectures, he conld not see how it was possible that they could ever exercise any influence as a body. His wish was to act upon liberal principles, but if the least danger was to be apprehended from the proposed measure, he would be the last person to support it.—The only effect which could result from the proposition, in his opinion, would be to bring a number of highly respectable gentlemen to the Lectures, and to increase the Library by the donations we should receive from them.

Mr. LAW opposed the Resolution. He was of the same opinion as the member who had observed that its effect would be to divide the Institution into two classes. Mr. Cobbett had stated at the Crown and Anchor, that except the Mechanics kept the Institution in their own hands, its prosperity was gone. Mr. Brougham had expressed a similar opinion. We had two *glorious* instances in the City of London of the effects of gentlemanly management, viz. Christ's Hospital and the Gresham Lectures, both of which had been perverted from their original purposes. This, he contended, would be the consequence of admitting persons who were not Mechanics into this institution. He could not see that a single advantage would result from the proposition, and should oppose it as a foolish act, which the Members would in time repent, if it were adopted.

Dr. GILCHRIST was happy to hear the two Members who had opposed the motion deliver their sentiments with so much credit to themselves, though their opinions differed from his own. How was it possible that gentlemen who would not even possess a deliberative voice in the Institution, should have the power of influencing its proceedings? He thought the opponents to the Resolution were fighting with windmills; for as the Society was so constituted

that two thirds of the Committee must be Mechanics, it was impossible that they could be out-voted in any measure they considered prejudicial to their interests, even if they so far stultified themselves as to elect persons who were likely to turn the tables upon them. He did not wish the Members to adopt the proposition because it was recommended by the Committee; but if they thought it improper, to reject it at once in a manly manner.

Previous to putting the Resolution, Dr. Birkbeck observed that in the instances of Christ's Hospital and the Gresham Lectures, alluded to by one of the Members, the individuals for whose benefit they were intended had no voice in the management of their affairs. The contrary was the case in this Institution, where the Mechanics composed two-thirds of the Committee, and unless it could be proved by Vulgar Fractions, that one-third was greater than two-thirds, there appeared no ground for apprehension. To constitute a donor an Honorary Member, was merely pronouncing their thanks in a handsome manner, and he should be sorry that liberality and kindness on the one part, should be met by frigid and repulsive conduct on the other.

Two or three other Members delivered their sentiments, after which the Resolution was put and carried by an overwhelming majority.

The proposition for admitting distinguished foreigners as Honorary Members, without donations, was carried unanimously after a brief discussion.

Two Resolutions which had been carried at the last General Meeting, were then brought a second time under the consideration of the Members, agreeably to the Rules. The first of these Resolutions gave to every Member recommending another a Free Admission to one Lecture for a friend; and the second gave a similar Free Admission to every Member on renewing his Quarterly Subsciption.

The first of these Resolutions being moved and seconded, a discussion of some length ensued, in the course of which several Members expressed a strong opinion that its adoption would lead to great inconvenience. It was suggested that power should be given to the Committee to issue a limited number of Free Admissions for each Lecture night; but it was observed by Dr. Gilchrist, that he, as one of the Committee, had no desire to possess such an invidious power. Power, it had been stated, was calculated to corrupt the best hearts, and it was his wish, that whatever measures might be adopted, with respect to Free Admissions, the Members should keep the power amongst themselves.

Mr. Gloyn proposed as an amendment, that the consideration of the subject should be pastponed till the next General Meeting, which would be held in the new Lecture-Room, when the Members would be better able to judge of the number of visitors that could be accommodated.

Mr. Blake strongly urged the propriety of agreeing to the Amendment. The proposed Resolution should be considered in connection with the proposition which accompanied it, and he feared the Members had not considered the probable effect of issuing so large a number of Free Admissions. Upwards of 400 new Members had been admitted during the last quarter, and as the Member admitted, as well as the two recommending Members, would each be entitled to a Free Admission, the number would exceed 1200; and if to this number was added one for each of the 1200 Members already belonging to the Institution, the total number of Free Admissions would be excessively large. If these Admissions could be equally divided among the lecture nights during the quarter, no great inconvenience might result; but it was more than probable, that vast numbers of them would pour in on those evenings when the lectures were likely to be particularly attractive; for it was exactly upon such occasions that the Members would introduce their friends, with a view of inducing them to join the Institution. For these reasons, he advised the Members to defer the question till they could discuss it in their new Lecture-rooms.

After a few remarks from Dr. Gilchrist, Mr. Gloyn, and Mr. Mote, the proposer of the Resolution at the last Meeting, the Amendment was put and carried by a large majority. The consideration of the second Proposition was also postponed.

Mr. Blake then read the Resolution passed at the last Quarterly Meeting, empowering the Committee, in case of a vacancy in their number, by death or otherwise, to fill it up with the name of the member next in rotation on the last ballotting list.

Mr. Law opposed the Resolution on the ground that such power ought not to be intrusted to the Committee. It seemed extraordinary to him that power should be given to them to elect Members of their own body, when they objected to exercise the power of merely issuing Free Admissions.

Dr. Birkbeck remarked, that in issu-

ing Free Admissions, the Committee might possibly be suspected of favoritism; but no such suspicion could attach to them, when they have no privilege of choice, and were merely empowered to take from a simple list, a name which the Members had placed there themselves.

The Resolution was then carried, and of course became incorporated with the Rules.

A proposition was then read, signed by Dr. GILCHRIST and several other Members, the object of which was that two of the four Vice-Presidents should go out by rotation half-yearly, and like the 30 Committee-men, should not be eligible for re-election till six months afterwards.

Dr. GILCHRIST observed, that he would not intrude long upon the Meeting at that late hour, as it was his intention to withdraw the Resolution for the present; particularly as it was probable that the Articles would shortly undergo a general revision. His opinion of the propriety of the proposition remained unchanged, and he should perhaps renew it at the next Quarterly Meeting.

The thanks of the Meeting were then unanimously voted to Messrs. OGG, WHEELER, LEWTHWAITE, JOPLING, and REYNOLDS, for their able Lectures delivered during the quarter:—to the Committee for their attention to the interests of the Institution;—to the Building Committee, for their exertions in the construction of the New Lecture Room;—and to the learned President, for his excellent conduct in the chair.

Dr. BIRKBECK said that it afforded him great pleasure to receive the thanks of the Members this evening, as well as upon every other occasion. He trusted that the efforts he had already made, and which they had honoured by their approbation, would be continued in future, as long as he had health and strength to bring them into operation. He was convinced that their kindness would put a favourable construction upon any instance of failure that might occur, and attribute it to want of power and not of good will towards them.

The Meeting was then adjourned, and the Members separated at about half past ten o'clock.

QUERIES.

No. 35.

By what means may insects that infest garden and other plants, and frequently ruin some of the most valuable productions of the earth, be utterly destroyed?

No. 36.

How do insects respire?

No. 37.

What are the properties of a polype?

No. 38.

AGRICULTURAL INQUIRIES.

1. How are soils divided: what are termed stiff or strong soils, and what light soils?

2. What sorts of grain are most suitable to stiff soils, and what to light soils?

3. What is meant by rotation of crops, and what is the use of it?

4. To what causes are barren soils to be attributed?

5. By what means may barren soils be rendered fertile?

W. H.

No. 39.

A country subscriber wishes to know—What are the best and cheapest family coffee-roasters.

ANSWER TO QUERY.

QUERY, No. 18, page 31.

A thin solution of isinglass in water, or very clear size, will fix either pencil or hard black chalk, &c. so as to prevent their rubbing out; or by the simple application of skimmed milk. The best way of using the latter, is to lay the drawing flat on the surface of the milk, and then taking it up expeditiously, to hang it by one corner till it drains and dries. Care must be taken that the milk is well skimmed, or it will grease the paper. The last method I have found to answer the purpose extremely well, as it is much easier, and leaves the paper entirely free from any stain.

Yours, &c. P. B. E.

TO CORRESPONDENTS.

From the great pressure of important matter which appears in our present number, we are unable to particularise the numerous favors of our correspondents. Several of them are necessarily postponed till next week, and others are under consideration.

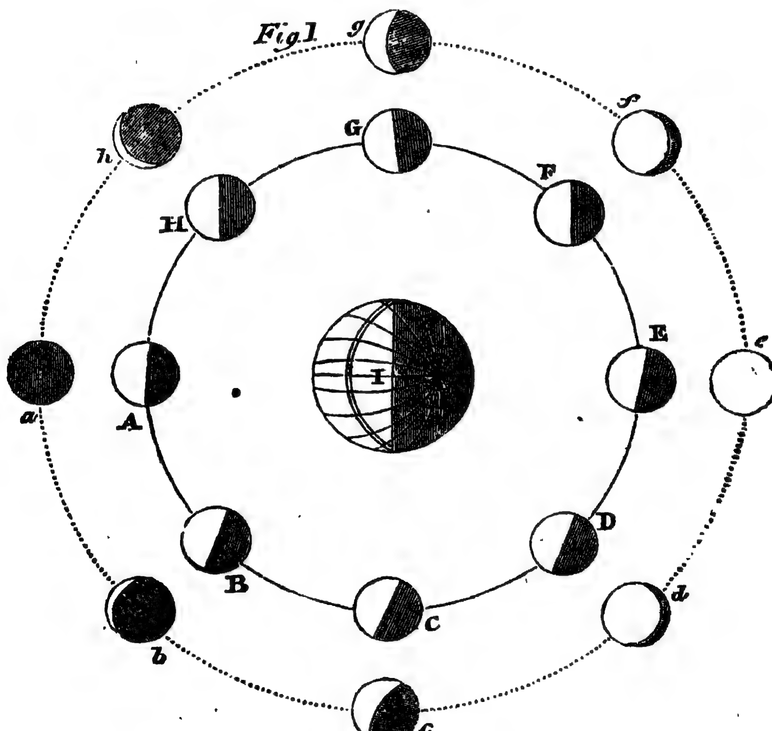
LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communications (post paid) are requested to be addressed.
Sold by SHERWOOD, JONES, & Co., Paternoster Row; and may be had of all Booksellers and Newsmen.
Also, Sold by A. & W. GALIGNANI, No. 18, Rue Vivienne, Paris; C. WILEY, New-York; CARFRAE, Rio Janiero.

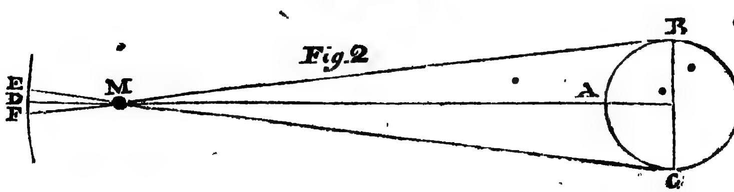
THE LONDON
MECHANICS' REGISTER.

"The MOON, whose orb
"Through optic glass the Tuscan artist views
"At evening from the top of Fesole,
"Or in Valdarno, to descry new lands,
"Rivers, or mountains in her spotty globe."---MILTON.

N°. 35.] SATURDAY, JUNE 11, 1825. [Price 3*d.*

PHASES OF THE MOON.





LONDON MECHANICS' INSTITUTION.

MR. WALLIS'S SECOND LECTURE ON ASTRONOMY.

REVOLUTION OF THE MOON ROUND THE EARTH—ITS HORIZONTAL PARALLAX—PHASES OF THE MOON—ITS TELESCOPIC APPEARANCE—REVOLUTION OF THE EARTH AND MOON ROUND THE SUN—LUNAR AND SOLAR ECLIPSES, &c.

FRIDAY, JUNE 3RD.

The lecture room of the institution was again crowded by the members this evening, for the purpose of hearing a continuation of Mr. WALLIS's Astronomical Lectures. The lecturer commenced by briefly adverting to the principal subjects of his previous discourse, in which he had treated, at considerable length, on the phenomena of our own planet. He had explained the apparent diurnal motion of the heavens by the revolution of the earth on its axis; and the inclination of the latter to the plane of its orbit in an angle of twenty-three and a half degrees, from which results the diversity of the seasons and the different lengths of the days and nights in all places possessing either north or south latitude. He had also illustrated the spheroidal form of the earth, upon which depends the constant return of the same seasons to the same climates for ever; thus fulfilling the promise of the GREAT CREATOR, that "while the earth remaineth, seed-time and harvest, and cold and heat, and summer and winter, and day and night shall not cease."

The present lecture will be devoted to a consideration of the moon, which, excepting the sun, is the most important object in the universe to us. The moon is a planet which revolves round the earth, but as both together annually revolve round the sun, the actual orbit of the moon is of rather a complicated nature. It is acted upon by two forces, by one of which it gravitates towards the earth, and by the other towards the sun. Mr. Wallis here exhibited two globes of different magnitudes, connected by a rod, and suspended by the centre of gravity, and observed that if we suppose them to represent the earth and moon, the latter will revolve round the former; the centre of the earth is not, however, the point round which the moon revolves, but a point which is the common centre of gravity to both of them; and the distance of this point from the earth's centre bears the same proportion to its distance from the moon, as the mass of the latter does to the mass of the former. The mass of the earth is to that of the moon as 68 to 1, and its bulk as 49 to 1. The orbit which the moon describes round the sun differs but little from that of the earth, which it crosses twice in each month.

The moon is an *opaque* and *dark body* in itself, receiving its light from the sun, and assuming different appearances as different portions of its enlightened surface are turned towards the earth. When the whole of its illuminated side is turned in that direction, it appears round, as on Tuesday last, when it was at the full. Now it is known that the moon is of a globular form, and as only half a globe can be illuminated at once, he would endeavour to exhibit the various phases of the moon by means of a globe, one half of which was white, and the other black. A globe of this kind was then produced, turning upon a pivot in a black frame, so that only half of it was visible to the audience. The whole of its white side representing the full-moon, was first exhibited, and as the dark edge, or boundary line of light and darkness, gradually advanced by turning the globe on its axis, the white hemisphere assumed in succession the gibbous, the half-moon, and the crescent form, till it entirely disappeared, and the whole of the black surface being now turned towards the audience, indicated the period of the new moon, at which time the whole of its dark side is turned towards the earth. If any additional proof of the moon's *sphericity* were wanting, it is found in the circumstance, that the *terminator*, or dark edge, advances much more rapidly at the time of the *half-moon*, than when it is near the *edge* or *limb* of the moon itself; for in this situation the enlightened part is seen in perspective and *fore-shortened*, so that the terminator passes through an inch of the surface, while it only appears to have described one-tenth of the distance.

The period in which the moon completes her revolution round the earth is called a *lunation*, and consists of about 29½ days; but owing to the motion of the earth in its orbit, the moon arrives at the same place in the heavens, and appears to have completed her revolution in 27 1-3rd days; the former being called the *synodical*, and the latter her *sidereal* month.

Mr. Wallis then observed that the diameter of the moon is 2144 miles, and that this fact was ascertained by an easy calculation, which he would endeavour to ex-

plain by means of a diagram. The diagram which is given in fig. 8 of our engraving, was then exhibited, and the lecturer stated, that to find the comparative magnitudes of the moon and the earth, it is only necessary to ascertain the moon's *horizontal parallax,* which is the difference between her apparent place in the heavens, as seen at the same time from two different parts of the earth's surface. To a spectator situated on the surface of the earth at A, the moon M will appear in the zenith at D; but an observer at B will see it in the heavens at F; and if viewedf rom the point C it will appear at E. The angle E M D is called the angle of parallax, which is found to be 57 minutes and 18 seconds of a degree; and as this angle is equal to the angle B M A, it is evident that double the angle of parallax is the angle under which the earth would be seen by a spectator at the moon, or the angle B M C. The moon's apparent diameter as seen from the earth, is 31 minutes 2 seconds, and from these data, the relative magnitude of the earth is found by a simple operation in the rule of three, thus:—As 1862 (the moon's apparent diameter in seconds) is to 6876 (double the angle of parallax in seconds) so is unity; or 1, to 3,69, the earth's apparent diameter as seen from the moon. Then as 3,69 : 1 : : 7912 (the diameter of the earth) 2144 the actual diameter of the moon.

Thus by ascertaining the moon's horizontal parallax, and knowing the magnitude of the earth, the size of the former is readily found; and it is also known by observations made during *eclipses,* that the moon is much less than the earth. A total eclipse of the moon lasts four hours, during two of which the moon is completely enveloped in the earth's shadow. This fact proves that the moon is less than the earth, and the latter less than the sun. Mr. Wallis here exhibited some diagrams, illustrative of the *conical* figure of the earth's shadow, and shewed that if the earth and sun were of equal magnitude, the shadow of the former would be *cylindrical;* and if on the contrary, the sun was less than the earth, the shadow of the latter would *diverge.* The lecturer also pointed out the *penumbral,* or faint divergent shadow of the earth, and stated that on the preceding Tuesday night, about 12 o'clock, the moon entered this shadow, and just touched the real one; but the eclipse lasted only half an hour.

In order to shew more distinctly the various *phases of the moon,* Mr. Wallis withdrew for a few moments, and on his return, a beautiful transparency was displayed to the audience, exhibiting the appearance of the moon in eight different parts of her orbit. Our first figure will convey a tolerable idea of this diagram, and the reader will imagine the sun situated at an immense distance on the left of the figure, and illuminating the moon in eight different positions, as at A, B, C, &c. When the moon is in *conjunction with the sun,* as at A, the whole of her dark side is turned towards the earth at I, and the moon is new, as at *a.* At B she has described one-eighth of her circuit, and a portion of her enlightened surface being now turned towards us, she is seen in the form of a crescent as at *b.* On arriving at C, she has completed her first quarter, and a larger part of her enlightened side being visible, she appears like a half-moon as at *c.* When she has proceeded as far as D, her enlightened hemisphere being still more turned in the direction of the earth, she assumes the gibbous form, as at *d;* and on arriving at E, she has finished half her journey, and being now in *opposition* to the sun, the whole of her enlightened side is presented to our view, and she appears at the full, as at *e.* After passing this point, the same changes occur in the contrary order, and her enlightened side gradually recedes from the view as she advances through F, G, and H, till she again arrives at A at the period of the new moon. All these phenomena therefore result from the motion of the moon round the earth, while the latter revolves round the sun. The planets *Venus* and *Mercury,* which revolve within the orbit of the earth, being like the moon, dark bodies which derive their light from the sun, are subject to the same phenomena, and undergo changes in their appearance similar to those of the moon.

Shortly after the period of the new moon, it appears in the form of a *crescent,* as in the transparency which Mr. Wallis now exhibited. It should be remarked that the earth and moon present the same phases to each other, but their order is reversed; for when the moon is *new* to us, the earth is a *full-moon* to her; and when she appears like a *crescent* to us, the earth assumes the *gibbous* form to her. It is remarkable that the illuminated part of the moon appears to form part of a larger circle than the obscure portion. This may be owing to its extreme brightness, or to its immense distance, in consequence of which it is not perfectly adapted to the naked eye; for when the telescope is used, this defect is remedied, and the enlightened part does not seem to encroach upon the fainter portion. The dark part of the moon being in

a slight degree enlightened by the earth, which is now nearly at the full, appears faintly visible.

The next transparency displayed, upon a large scale, a beautiful representation of the telescopic appearance of the moon when about four days old. The inner edge of the illuminated portion was extremely ragged and irregular, and afforded ample evidence that its surface is diversified by excavations and mountains, the latter of which are known by the shadows they cast. That they are actually mountains is strikingly proved by the increase or decrease in the *length* of these shadows, according to the direction in which the sun's rays fall upon them, for when the sun shines directly upon them, no shadow is seen. In this enlarged diagram, as in the former, the dark portion of the moon was faintly seen, owing to the light it receives from the illuminated part of the earth, which appears thirteen times larger than the moon.

By using telescopes of very high magnifying powers, a number of very curious spots are distinguished. Three of these the lecturer pointed out, called by astronomers, *Aristarchus*, *Ptolemæus*, and *Gassendus*, the former of which is the brightest spot on the moon's surface. As a further proof of the existence of mountains in the moon, the lecturer directed the attention of the spectators to a number of bright spots within the ragged edge of the terminator; these are the summits of mountains, which become visible from their receiving the light of the sun sooner than the general surface of the moon.

The irregularity of the moon's surface was further illustrated by a transparency representing the solar eclipse of 1821. This eclipse afforded a favorable opportunity for observation, and the edge of the moon's shadow, as it passed over the surface of the sun, was evidently jagged and irregular.

A brilliantly illuminated view of the whole surface of the moon was next displayed to the audience, and presented upon an extended scale, a perfect map of this interesting planet, as it appears at the full. Mr. Wallis then proceeded to particularise the most important appearances assumed by various portions of the surface, of which a considerable part is permanently dark, and is supposed to consist of seas, similar to our own, while the bright spots are always bright. The mountains seem of a sharp and pointed character, and are frequently divided into two or three peaks. Other mountains appear *volcanic*, or like Etna if viewed from a great distance above it, and several of the bright spots which are seen on the dark part are supposed to be volcanoes.

That the moon possesses an atmosphere is inferred from observations on the occultations of Jupiter. When this planet touches the dark edge of the moon, it is observed, at the moment of contact, to be discolored in light, and distorted in appearance; and this can only be accounted for by the refraction of the moon's atmosphere. The occultations of the fixed stars are too instantaneous to afford opportunities for discovering the atmosphere of the moon; but those of Jupiter last 65 seconds before the planet becomes invisible.

It may seem singular that the moon should assume such a bright appearance, if it is composed of materials similar to the earth, but this is owing to its being seen at so great a distance, and the light being transmitted to the eye from so many points at once. A house, strongly illuminated by the rays of the sun, appears at a distance nearly as bright as the moon, and the lecturer had no doubt that the earth appears as bright as the moon, and is equally well adapted to reflect light.

Another transparency was then prepared, in which the moon was seen revolving round the earth, while the latter revolved on its axis in the centre of the figure. The intention of this diagram was to shew that the moon revolves once on her own axis in exactly the same time which she takes to revolve ronnd the earth, from any particular star till she arrives at the same star again; in consequence of which the same side of the moon is always turned towards the earth. This fact was clearly exhibited by the combined motions of the two planets in the transparency; and was rendered further evident by a different adjustment of the machinery, by which it appeared that if the moon revolved round the earth without turning upon its axis, while the earth revolved in its own orbit, we should see all round the moon during its progress, which is not the case in nature.

What is called the moon's *librations*, is a slight deviation from the motion just described, owing to her moving round the earth in an orbit of an *elliptical* or *oval* form, in consequence of which she is nearer to the earth in one part of her revolution than in another. All planetary motion is, in fact, *elliptical*, and this, which was supposed by the old astronomers to be a defect, would be proved to be the very perfection of the system, and the grand principle by which its permanency is maintained.

The next transparent diagram afforded a brilliant representation of the sun in the centre, with the earth revolving round it, while the moon revolved the earth, and accompanied it in its progress. The motions thus exhibited, illustrated very clearly the difference between the *synodical* and *sidereal months*, and proved that the sidereal must always fall short of the synodical month; or the period of a lunation, as stated in the former part of the lecture.

Mr. Wallis now proceeded to illustrate the important subject of the *eclipses* both of the sun and moon, which he explained by means of two rings, about three feet in diameter, and of different colours; one of which represented the moon's orbit, and the other the ecliptic, or the great circle which the sun appears to describe in the heavens. He shewed that if these two circles coincided, or were in *the same plane*, there would be an eclipse of the sun at every new moon; and that at every full moon, there would be a lunar eclipse, in consequence of the moon's passing through the earth's shadow. This however is not the case, as the orbit of the moon is inclined to the plane of the ecliptic, and the moon therefore passes either above or below the shadow of the earth, except at the period of the full-moon, she is in or near one of her *nodes*, or those points in which the two circles intersect each other. For the same reason, the moon's shadow can only fall upon the earth so as to occasion a solar eclipse, when the new moon happens in or near the nodes. The obliquity of the moon's orbit is therefore the reason why eclipses do not occur at every revolution.

Mr. Wallis's beautiful transparent machinery was again put in requisition for the purpose of exhibiting the general nature of *eclipses*. The first transparency represented a partial eclipse of the moon, which was seen gradually immerging itself in the earth's shadow, till a considerable part of its luminous surface was obscured, when it slowly emerged till it resumed its circular form, and the eclipse ended. *Lunar eclipses* can only occur when the moon is at the full, and in *opposition* to the sun, and are occasioned by her passing through the shadow of the earth, which is 840,000 miles in length. As this shadow is of a *conical* form, its diameter must be considerably less than that of the earth at a distance of 240,000 miles; and it is another proof of the earth's being much larger than the moon, that the shadow of the earth upon the moon's surface is always a segment of a larger circle.

A *total* and *central eclipse* of the moon was admirably represented by the next transparency. An eclipse of this kind can only happen when the moon is exactly in the *node* at the time of opposition, in which case it remains enveloped in the shadow of the earth two hours; and as it passes through the centre of the shadow, which is considerably darker than near the edges, the moon is more completely obscured.

Mr. Wallis then exhibited two transparent representations of *solar eclipses*, the first of which was a total and central eclipse of the sun. These eclipses can only happen when the sun is at its greatest, and the moon at its least distance from the earth, and are therefore of rare occurrence. The last seen in this country was observed by Dr. Halley, in the year 1715. The total obscuration of the sun cannot, in any case, exceed eight minutes in duration.

The last of the splendid luminous diagrams exhibited during the Lecture, presented a striking representation of that extraordinary phenomenon of nature, an *annular eclipse* of the sun. In this transparency the opaque body of the moon was seen slowly advancing across the disc of the sun, till it covered the whole surface of the luminary, with the exception of the brilliant *annulus*, or ring of light which incircles it, and from which the eclipse derives its name. An annular eclipse is *central*, but not *total*; for the moon being at this time in her *apogee*, or at her greatest distance from the earth, her shadow terminates at some distance from its surface. Even when nearest to the earth, or in her *perigee*, her shadow never falls upon more than 180 miles of the surface. During total eclipses of the sun, small stars become visible, and at the period of the great solar eclipse in 1820, at which time 10¼ digits out of the 12 were obscured, the planets Mercury and Venus could be seen by the naked eye.

Mr. Wallis concluded by stating that in his next lecture he should treat of the principles of attraction, the influence of the moon in the production of tides; and several other astronomical phenomena which he had not yet elucidated.

LECTURES FOR NEXT WEEK.

Wednesday, June 15, Mr. Lewthwaite's Lecture on the Blow Pipe.

Friday, June 17, Mr. Wallis's Fourth Lecture on Astronomy.

SPITALFIELDS MECHANICS' INSTITUTION.

Though some weeks have elapsed since we noticed the progress of this recently established institution, the omission has not arisen from any abatement of the warm interest we felt in its formation, and continue

to feel for its prosperity, but from the press of important communications with which we have been lately favoured.

Since the conclusion of Mr. WALLIS's engagement, Mr. PARTINGTON (who kindly and gratuitously delivered the three introductory lectures prior to the formation of the institution) has been engaged for a period of six months to deliver a general course of lectures on the principles of Natural Philosophy. He has already delivered six lectures, the first was confined to the properties of matter, but principally to the theory of *gravitation*. The four succeeding lectures were devoted to the interesting science of *electricity*, illustrated by many pleasing and striking experiments; and the last was on the subject of *magnetism*, in which Mr. PARTINGTON traced its rise and progress, and shewed, in a most convincing manner, its importance to a maritime nation. The directive properties of the magnetic needle, as well as its declination and variation, were most clearly and satisfactorily illustrated by a series of ingenious and well conducted experiments. Mr. Pope's improved Dipping Needle Compass, introduced by Dr. BIRKBECK in his lectures at the LONDON MECHANICS' INSTITUTION, and described at the commencement of our present volume, was exhibited, explained, and compared with the common mariner's compass, and we were glad to perceive that the merits of this simple but important contrivance were duly appreciated by the members present. Towards the conclusion of the lecture, Mr. Partington introduced to the notice of the meeting Mr. Sturgeon, shoe-maker, of Woolwich, who has greatly simplified the electro-magnetic apparatus of Messrs. Faraday, Ampere, Barlow, &c. to perform some experiments on his newly constructed apparatus. Mr. S. who was received with the most marked demonstrations of respect and cordiality, commenced by giving an historical account of the several discoveries made in this new department of science. He then described the manner in which the experiments had heretofore been performed by the above gentlemen, and instituted a comparison between their methods and the one he was about to adopt. Experiments of this nature are usually performed by means of a powerful battery of at least several feet surface; but on this occasion the deflection of the magnetic needle from the plane of the magnetic meridian, the rotation of the galvanic wire about the pole of the magnet, the revolution of the magnet about the galvanic wire, and the oscillatory motion of the galvanic wire between the poles of a horse-shoe magnet, were effected by the agency of a battery that contained less than half a pint of diluted acid. The experiments were conducted with great success, and Mr. S's explanations were highly satisfactory. Mr. PARTINGTON then charged a very extensive galvanic battery, which had been provided for the purpose by the apparatus committee of the institution, and having excluded the light, performed a series of experiments in the deflagration of metals and the combustion of charcoal, to the great delight of the auditory. After which he announced his intention of commencing the subject of Optics with his next lecture.

At the conclusion of the lecture on Monday week, the President THOS. GIBSON, Esq. informed the members present, that the committee had determined upon the establishment of classes for the instruction of as many as were desirous of availing themselves of the opportunity, in *writing*, *arithmetic*, and *French*. The satisfaction this announcement afforded, was strikingly manifested by the rapturous applause with which it was received.

We are happy to congratulate the members of the institution upon the active and successful exertions of their committee to accomplish the important objects for which the institution is designed. For though the institution has not been established more than ten weeks, the reading rooms, comfortably and conveniently fitted-up, have been open for the accommodation of the members, considerably more than half that period. The tables of the reading-rooms are furnished with the most esteemed weekly, monthly, and quarterly periodicals; in addition to which there is a library accessible to the members, containing already upwards of 200 volumes, of general interest, of which the greater part have been presented to the institution, and the committee anticipate the receipt of a much larger number when it is known that their arrangements for placing them in the library are now complete.

The present number of members is very nearly 400, so great has been the increase since our last notice; and as many are waiting the termination of the quarter previous to joining the society, it is expected that the number of members will be considerably augmented after that period.

The majority of the members attend the lectures, and appear to receive the lecturer's explanations and illustrations with much satisfaction.

COMBINATION LAWS.

A pamphlet on this important subject

has recently appeared, from the pen of that steady and indefatigable friend to the operative classes, Mr. PLACE, of Charing-cross. It is intitled "Observations on Mr. Huskisson's speech on the laws relating to Combinations of Workmen," delivered by that gentleman at the commencement of the present session of parliament, when he moved for the appointment of a committee, to enquire into the effects which had resulted from the repeal of these laws during the preceding session, and to report their opinion how far it might be necessary to repeal or amend the act by which they were abolished. Mr. Place introduces the subject by the following observations:—

"In the last session, the parliament, with much credit to itself, *unanimously* repealed all the laws which forbid workmen to combine to raise their wages, or to regulate the hours of working. The measure was a wise one: it has already caused a considerable improvement among the working people—has, to a great extent, removed the evils which the laws it repealed had produced—has put an end to the enormous cruelties, which those laws gave bad men the power to inflict, and to the practice of cruelty, which under those laws was frequently inflicted on workmen. In a vast many instances such an approximation towards a good understanding between workmen and their employers has been made, as bids fair to extinguish for ever those feelings of suspicion, jealousy, and hatred, which kept the masters and workmen more or less in a state of hostility, debased the people, and made them worse members of society than but for these laws they would have been. The barbarous way in which the laws were frequently applied, and the constant apprehension that even, for the most meritorious conduct, these acts might be resorted to, had separated the two classes of masters and workmen so completely, had made them so universally enemies, as to make it doubtful with many whether or not they could be reconciled. Yet the repeal of these partial, unjust and cruel laws has already done much towards effecting this desirable purpose, and will, if our legislators have a little patience, produce a state of things which, when compared with the former state of things, will both deserve and receive the approbation of every man, who has not from feelings of pride, or from such an inordinate desire of gain as overpowers all benevolent feelings, become indifferent to the welfare of the great body of the people, careless whether they become respectable in their demeanour, decent in their persons, and well-instructed in their duties, or be put back into a state of ignorance and barbarism.

"Let the law remain as it is for but two or three years, and such a progress will be made towards all that is desirable in the state of the working people, that it will be quite impossible for any one to doubt the wisdom of that parliament, which repealed the laws against combinations. To the advocates for the re-enactment of the laws or any modification of them, it may be observed, that now, when education has made great strides and is rapidly becoming universal, when schools and book clubs are continually increasing, when institutions are being established in most of the principal towns in the kingdom, for teaching the working people, not only what, as to them, was formerly called education; namely, to spell a sentence and scrawl their names, but to instruct them, in trade, art, and science, and in moral duties, *it is quite impossible for them to retrograde in knowledge; they can never again sink on the scale of society—they can never again be classed promiscuously with the dissolute and abandoned.* A separation has already commenced, and those who will neither learn, nor practise the duties of good citizens, will soon be discarded and become a distinct grade, equally the contempt of the well-informed working people, and of those whose circumstances place them higher on the scale of society. The impulse has been given, it has been and continues to be accelerated, *it can never more be stayed.* In such a state of society, with such certain prospects of improvement, either the law must accord with the state of the people, or the people will despise the law and those law makers, which and who, they see and feel, are too barbarous, and too ignorant, or too careless of the absurdities they commit, and the evils they heap upon those, whose intelligence and moral worth fairly intitle them to treatment directly the reverse."

Mr. PLACE then observes that Mr. Huskisson's speech was made up of complaints and suggestions, the principal of which were:

"1. That the committee which sat last year, and recommended the repeal of the laws against combinations, made no report.

"2. That the bill went through the house precipitately,

"3. That it repealed thirty or forty acts of parliament.

"4. That it set aside the common law.

"5. That it induced workmen to think it made combination a duty.

"6. That the conduct of workmen was such, 'that unless parliament speedily interfered with some legislative measure to prevent such proceedings from arriving at maturity, his right honourable friend (the home secretary) would, ere long, have to deal with them *in another way*, and would have to exert all the civil authority with which he was vested, to protect the property and liberty of the king's subjects from the formidable conspiracy which appeared organized against them.'"

To all these objections the writer replies with considerable ability, and amongst a variety of remarks, in which he strongly deprecates the re-enactment of the COMBINATION LAWS, the following passages occur, which will afford our readers a specimen of the temperate tone of argument adopted throughout the pamphlet:—

"No fear need be entertained that any combination of workmen will ever be able to keep wages for any considerable time at an exorbitant height. Wages are ultimately regulated by the same laws as profits; and if no mischievous law interferes, both wages and profits will become just what the best interests of the community require they should be. Combinations will occasionally exist, so long as the numbers of workmen are in excess; but they will be divested of their obnoxious character at no distant period, if they be let alone."

"Workmen dread strikes; those who know but little of the habits and circumstances of the working-people, talk of strikes as if they were amusements, beneficial amusements; but this is a gross mistake: workmen dread strikes, and well they may: to them a strike, even under favourable circumstances, is a severe punishment; no one ever enters into a strike willingly, every one dreads a repetition. There are in every trade a large number of workmen, whom nothing can ever induce to go heartily into any strike; many absolutely refuse to strike; and many desert their fellows when they have struck. When experience shall have shown, as it will show, if the men be let alone, that all reasonable and proper objects can be obtained by modes less objectionable, and less injurious to themselves, than those the laws compelled them to resort to, unions, and delegates, and intimidation, and violence, will no longer be heard of. Temporary associations, or combinations, as well of masters as of men, must occasionally take place: many matters can be regulated in no other way, and by no other means; but, beyond these, there will be very little association of any kind, nothing deserving the name of combination in the sense this word is usually understood."

"Let us hope the legislature will leave these matters to time, and not, by meddling, make them worse. No law can remedy the inconveniences which must occasionally occur—no law is necessary to punish violence—violence may be punished by existing laws—if let alone, little violence will take place—make a law on the subject, and discontent and violence will increase. The evils occasioned by the laws against combinations, are rapidly declining; satisfactory arrangements have been made in many places between masters and men, which never could have been made under the old laws; and if government cease to agitate the question, and leave the masters and men to themselves, these arrangements will become general."

"Mr. Huskisson's speech has agitated the people all over the kingdom. They are, however, ready and willing to have their conduct thoroughly investigated; and if the committee, following the example set by the committee in the last session, will but give them a full and patient hearing, they will make such a case as cannot fail to convince every unprejudiced man, that the repeal of the combination laws has already conferred a great blessing on them; has led, and will continue to lead, to a state of things equally beneficial to them and to the nation."

The preceding paragraph concludes Mr. Place's pamphlet, and we cannot but heartily concur in the hope it expresses, that the operative classes, as well as those who complain of their conduct, may have "*a full and patient hearing*" before the committee. We are the more earnest on this subject, because we are aware that the following letter has excited some apprehensions that the committee are more disposed to inquire into the *bad* than the *good* effects which have resulted from the repeal of the Combination Laws. The letter is addressed by Mr. HUME to Mr. John Tait, of Glasgow, in reply to a communication from the latter gentleman:—

London, 12th May. 1825.

SIR—I have to acknowledge the receipt of your letter of the 5th instant, and to inform you in answer to it, that it does not appear to be the intention of the committee at present to hear any evidence, *except in cases where complaints have been*

brought against the workmen. Should there, however, be any thing peculiar in your case, I would recommend you to state the same to the president of the committee. I may state also for your information, that the sheriff's deputies of Lanark and Renfrewshire, have been summoned to give evidence; and that if any thing should come out, in the course of their examination, against the operative weavers, I presume the committee will do them the justice *to hear their statement of the matter also.*—I remain, Sir,

Your obedient servant,
JOSEPH HUME.

ENGLISH GRAMMAR.

To the Editor of the Mechanics' Register.

Sir—I perceive, with pleasure, that while your work is professedly devoted to mechanical subjects, it does not confine itself wholly to them; but is at all times ready to receive communications on any subject likely to prove interesting. This occasions a variety it would not otherwise possess; and which, no doubt, greatly contributes to its success.

In a late number appeared some observations on English Grammar, by "S. M. T.," the perusal of which has afforded me much satisfaction. Your correspondent, indeed, modestly intimates his fears, lest his remarks should prove "neither amusing, or (*nor*) instructive;" but I am persuaded your readers will entertain a different opinion. As he requests an explanation from some of your correspondents, I shall, with your permission, make a few observations on those points on which he has touched.

Your correspondent sets out with assuming that the apostrophic *s* "is not *a different termination of a noun*, constituting a case, or any part of it; but an abbreviation of the word, *his*." Let me remind him, however, that this point is at least disputed; and that Dr. Johnson, and Dr. Ash, are of a different opinion. Murray, I believe, says nothing, as to the derivation of the *s*; and I have not the pleasure of being acquainted with the grammarians your correspondent mentions, Lowth, Hornsey, and Fearn; but it appears to me, that when he has such a master of the English language, as Johnson, against him, it would be well for S. M. T. fully to examine the foundation on which he rests his opinion, before proceeding to promulgate it. This termination is of Saxon origin; let us, therefore, take a noun, declined after the Saxon mode, and we shall see this more clearly.

Nom. ſmið, *smith;*

Gen. ſmiðeſ, *smithes;*

Plu. ſmiðeſ, *or* ſmiðaſ, *smithes,* or *smithas.*

In this instance, at least, the *s* "*is* a different termination of a noun, constituting a case;" so that if, when he says "they *formerly* wrote John his book", he means that this was the *original* mode of expressing "the possessive, or *genitive* case", it would appear that he is mistaken; since the termination *es* has evidently the priority. This example of the *original* declension of nouns might, perhaps, go far to invalidate what S. M. T. so decidedly calls "a *proof* that English nouns undergo no change whatever, but what their *genders* require." (Their *numbers*, it is presumed, must also be excepted.) Let us hear, however, what the Doctor says:—

"These genitives (*of nouns*) are always written with a mark of elision, *master's*, *scholar's*, according to an opinion long received, that the *'s* is a contraction of *his;* as the *soldier's valour*, for the *soldier his valour*. But this cannot be the true original, because *'s* is put to female nouns; as *woman's* beauty, the *virgin's* delicacy, 'haughty *Juno's* unrelenting hate;' and collective nouns, *women's* passions, the *rabble's* insolence, the *multitude's* folly. In all these cases it is apparent *his* cannot be understood.

"This termination of the noun seems to *constitute a real genitive*, indicating possession. It is a further confirmation of this opinion, that in the old poets, both the genitive and the plural were longer by a syllable than the original word; as *knitis*, for *knight's*, in Chaucer; *leavis*, for *leaves*, in Spenser."

It will be seen here that examples similar to those which your correspondent makes use of in support of his sentiments, "*John's book*," "Mary's book," are employed by his antagonist in favour of a contrary opinion. It but rarely happens that any proposition can be both supported and opposed by the same arguments.

Dr. Johnson, then, and S. M. T. are at issue. The former says the *s* is a contraction of *es*, which "*is* a different termination of a noun, constituting a case;" the latter that it is "an abbreviation of the word *his*." In the one case the use of such phrases as these, "*Mary's book*," "LONDON MECHANICS' INSTITUTION," &c. will be perfectly correct; while in the other their employment will be decidedly improper; "*Mary his book*," "MECHANICS HIS INSTITUTION."

I have mentioned the name of Dr. Ash, as coinciding in opinion with Dr. Johnson.

In his "Grammatical Institutes" he has the following observations:—

"In the formation of this case (*the genitive*) I have complied with a late refinement, and what I really think a corrupt custom. The genitive case, in my opinion, might be much more properly formed by adding *s*, or, when the pronunciation requires it, *es*, without an apostrophe; as men, *mens*; ox, *oxes*; horse, *horses*; ass, *asses*.

"This case undoubtedly came from the Saxon: and the best English writers after the Norman conquest, even down to the time of Chaucer and the Reformation, formed it just in the same manner as they did the *plural number*, viz. by the addition of *s*, *es*, or *is*; and were rather sparing in the use of it. After that the *is* and *es* were discontinued by degrees, though the latter, in a few instances, is retained to this day in the version of the Bible.

"As to the apostrophe, it was seldom used to distinguish the genitive case, till about the beginning of the present (*the eighteenth*) century, and then seems to have been introduced by mistake. At that time the genitive case was supposed to have had its original from a contraction; as *John's* book, for *John his* book; but that notion has *sufficiently exploded*: and, therefore, the use of the apostrophe, especially in those instances where the pronunciation requires an additional syllable, is, I presume, quite indefensible. To write *ox's*, *ass's*, *fox's*, and at the same time pronounce it *oxes*, *asses*, *foxes*, is such a departure from the *original formation*, at least in writing, and such an inconsistent use of the apostrophe, as cannot, perhaps, be equalled in any other language."

From these extracts your correspondent will perceive that the point which he assumes as, at least, doubtful, and that, in support of his opinion, he has to contend with no mean antagonists. It will, of course, be for your readers to determine which side has the best of the argument.

We have now arrived at the second "peculiarity" which your correspondent mentions. "Two negatives make an affirmative, but the use of them is improper." As to the first part of this sentence, its correctness will not be questioned; but the second requires a little examination. Mr. Murray has the following rules:—

"Two negatives, in English, destroy one another, or are equivalent to an affirmative: as, '*Nor* did they *not* perceive him;' that is, 'they did perceive him.' 'His language, though inelegant, is *not* ungrammatical;' that is, 'it is grammatical.'

"It is better to express an affirmation by a regular affirmative, than by two separate negatives, as in the former sentence. But when one of the negatives is joined to another word, as in the latter sentence, the two negatives form a pleasing and delicate variety of expression."

According to this grammarian, then, it would be wrong to say, "he is *not not like* his father;" but if we join one negative to the adjective, and say, "he is *not unlike* his father," the mode of expression will be perfectly correct.

Not being acquainted, as I before stated, with Dr. Lowth, I do not know his opinion on the subject; but I presume, from what your correspondent says, that he and Mr. Murray differ. It might, perhaps, be considered presumptuous in me to hazard an opinion on a point controverted by such eminent men, for,

"Who shall decide when doctors disagree?"

It appears to me, however, that the propriety or impropriety of a sentence, is dependent on the practice of the most approved writers in our language; and not on the opinion of a few men, styled grammarians. In proof of this I might adduce what your correspondent says, that "there are scarcely two of them who agree on many of the chief points of grammar." In fact, a principal guide in the formation of their rules must be the writings of eminent and approved authors; and whenever they disagree, as in the present instance, those writings are the standard to which they should refer. In this view of the case I should certainly be inclined to favour Mr. Murray; and your correspondent allows that I am supported in my opinion by "the best writers."

Your correspondent's observations on the necessity of an early and familiar acquaintance with English grammar, coincide with my own sentiments. That "many stand in need of this useful acquirement," our daily intercourse with the world will suffice to convince us. It would be impossible to notice the many instances in which the rules of grammar are continually violated; they are such as must instantly occur to our recollection. A person has only to notice the names, &c. over shop doors, as he passes along the streets, and he will find that, in one case out of thee, the writer was deplorably ignorant of that part of grammar, called punctuation. One practice, I fear, is gaining ground among us; which, to say the least of it, is an evidence of false taste. I allude to the custom of making those words properly used only in the singular, plural. How often does such an advertisement as the following meet our

eye:—"S. Stevens, and Sons; dealers in foreign wines and spirits. Ports, hocks, and sherries; rums, gins, and brandies, of the best qualities, and at the lowest prices." No doubt the worthy wine-merchant thought this had a very delightful, hissing sound; and, perhaps, if questioned on the subject, would have alledged that the plural number conveys the idea of different kinds of port, sherry, &c. But this object might have been easily secured by a slight variation in the form of the sentence, and I am persuaded every person who has a taste for propriety of language, will reject the *innovation* with disgust.

Your correspondent will permit me to join with him in recommending that attention should be paid to this subject by the LONDON MECHANICS' INSTITUTION. There is certainly great room for improvement. Mr. Black has invented a new method of instructing in French; surely there must be some better mode of teaching English, to be discovered, than that at present employed. Still, it must be remembered, "there is no royal road to knowledge;" and, whatever mode of teaching may be adopted, diligent attention will be essentially necessary to its acquirement. At the SPITALFIELDS MECHANICS' INSTITUTION, schools are about to be opened for instruction in writing; and I should hope that so important an object as instruction in English grammar will not be lost sight of. I am not on the committee, or I should take an opportunity of bringing the subject forward.

In conclusion, I beg leave to offer to your correspondent my sincere thanks for having challenged attention in so public a manner; and I hope it will lead to the adoption of some measures, in furtherance of the important object he contemplates.

I am, Sir,

Your obedient servant, N. R.

*** Another correspondent (Mr. Cooper) after stating his opinion that the *'s* forms a component part of the noun, and denotes the possessive case, observes that the judicious use of the two negatives sometimes gives a peculiar turn to the sentence. In the example adduced by S. M. T. "He is *not unlike* his father," may imply a great approximation to a similitude, though not an exact similitude.

CASPIAN SEA.

To the Editor of the Mechanics' Register.

SIR—Travelling through various provinces of Russia in the year 1817, I had an opportunity of very closely observing the shores of the three extensive lakes called Ladoga, Onega, and Bello-ezero, also a vast number of others in that empire of less extent.—One evening while I was employed sketching, near the margin of the White Lake at Krokins, a gentleman hearing I was an Englishman, came up and addressed me in the English language, and a conversation ensued which related principally to such internal seas, in various parts of the world. He informed me that he had lately received from England a supplementary volume to the *Encyclopædia Britannica*, and had read therein a paragraph which stated that a positive difference in level of 334 feet existed between the surfaces of the Caspian and Black Seas, which difference had been ascertained by two Prussian gentlemen, who proceeded across the country from the mouth of the Coban River at the Black Sea, to the embouchure of the River Terek at the Caspian.

In the course of the year 1818, I procured a sight of the volume alluded to, and perused the statement with the greatest attention; but not feeling disposed to assent to the truth of it, I employed subsequently parts of my leisure time in the investigation of this matter, by every means within my power; and also consulted a gentleman who had been officially employed respecting the opening of some communication between the Rivers Volga and Don.

From the account I then received, there did not appear to be more than a few feet difference in level, and from all the particulars I have been enabled to collect, there is not a foot difference between his calculations and my own. I must however observe, that my data were not taken from any official sources, but from a great variety of statements as to particular places, and a calculation of the falls of many considerable rivers, particularly of the Rivers Volga and Sheksna. In the year 1761, levels were taken along the Volga, from Twer to opposite Cazan, near 700 miles; and in 1822 I had completed a section of the country, from the Gulph of Finland to Ribinsk on the Volga, nearly the same length; and from these falls compared with those of other great rivers, the fall of the Volga below Cazan to the Caspian Sea was computed. There does not appear to have been any levels taken from the Black Sea to the Caspian, from which the difference between those two seas might be correctly ascertained. However, the paragraph alluded to is not credited by any scientific friends of mine in Russia, nor to the assertion made to me in the first instance did I attach the least credence.

I cannot suppose it possible for the sur-

face of any lake, or inland sea, such as the Caspian, to be lower than the ocean. I think it is generally admitted, that every country *rises* from the sea which washes its shores, however imperceptible such rise may appear; and except in those parts of the coasts of Europe which have been rescued from the sea by embankments, and which were *a priori* periodically overflowed at spring tides, I know of none lower, nor have I heard or read of such. I cannot conceive how the interior of any continent, country, or island, of this earth, can be lower than the general curve of the seas surrounding them.

As to what is mentioned by Professor Pallas, respecting the Caspian having fallen to a lower level than the ocean, it amounts to nothing; being asserted merely from ocular observation: and no man, without *levelling*, is competent to state what the Professor has on this head, from view only, more especially in a region so wild and extensive. With respect to a very great contraction of the limits of the Caspian Sea from former times, I fully agree to that; and also to the assertion that evaporation through the year counterbalances the influx of waters from the Volga and other considerable rivers. The idea of subterraneous communication for the discharge of these waters into the Persian Gulph, has been exploded many years ago in Russia, after various soundings and examinations.

I do not altogether object to the opinions of some, that formerly there was a communication between the waters of the Black Sea and the Caspian, but then a vast extent of Tartary must have been under water, which for ages past has been inhabited, as may be read in various authors. As to the gradual subsiding or diminution of the sea, I am of that opinion, and on that head, think I shall meet with few dissentients who have been extensive travellers; for I have seen the coasts of the greatest part of the British Empire, and a portion of those of the continent of Europe; and every appearance tends to indicate, justify and confirm an opinion that the sea has once been at a far higher level than at present, and the cliffs near the road from Tsaritzin towards the two upper Salt lakes, and which cliffs, before coming in sight of them, take an inclination westward to the Volga, near Kamishinsk, at a great distance from the present shores of the Caspian, are undoubtedly its former boundary, as supposed by Pallas, and Tournefort before him.

In some ancient authors, the Caspian has a very different figure from what was ascertained in the reign of Peter the Great; but it was sufficiently limited to prove, that although the lake of Aralh might then be united with it, those waters did not extend so far as the mountains near the cities of Cashgar, or Samercand; for if so, as I have before observed, the whole of Independent Tartary, part of Chinese Tartary, part of Persia, and a large extent of several Russian provinces, would have been one sea, to an aggregate extent of not less than 1,200,000 square miles, which never would have been silently passed over or omitted in the Periplus of Scylax by Strabo, or by Ptolemy, had such sea existed.

I am inclined to suppose the paragraph in the supplementary volume was inserted without much consideration by the editors, or what the effect would be of an elevation of water to the height of 334 feet above the present surface of the Caspian. My sole object is to attract attention to that paragraph, and to convince you, Sir, that I only write this for the purpose of meeting the subject openly in all its bearings, at a future time, provided you deem this worthy of insertion in your valuable publication, and any of your numerous scientific readers who may feel inclined to set me right as to my theoretical opinion, will thereby confer on me a particular favour. I trust you will receive both mine and theirs, and permit them to appear; for in addition to the strong doubts I have of the care and attention of the most skilful practitioner, with the best barometer, for a distance of 990 versts, to ascertain correctly such a small presumed difference, I discover an error in the distance, which is stated at 711 English miles by the Prussian gentlemen, whereas it should have been but 656 miles, 2 furlongs; a Russian verst being 66287 of an English mile.

I shall be thankful for any opinion on the above subject, which, had I possessed earlier from some gentleman in England, of much superior knowledge, most likely this paper would never have been handed to you. A positive contradiction to the statement cannot be given from a series of levels taken in a practical manner with a spirit level; but from my investigation of the subject, partly by practice, and partly by theory, in addition to the unanimous opinion of several gentlemen of science abroad, taken in 1822 and 1823, the assertion of 334 feet difference of level between those seas was considered the most erroneous statement that had appeared in any English work of modern times.

I have the honour to be, Sir,

Your most humble servant,

London, May, 1825. W. C.

VARIATION OF THE MAGNETIC NEEDLE.

Sir—The direction of the needle has been observed to vary in different latitudes, and likewise in different longitudes; the probable cause of the variation appears to me to be the difference in the counteracting power of the south and the north poles on the south and the poles of the needle, in consequence of the magnetic poles not being situated at the exact poles of the globe. Farther, the variation of the needle at different times in the same place is produced by means of the physical variation in the influence of the magnetic poles on the poles of the needle. Now it is evident to me that the variation of the needle arises from the imperfect mode of fixing it, so as to expose its poles to the liability of being counteracted. Had the magnetic poles been situated exactly at the poles of our globe, the present mode of fixing the needle would not be liable to the variation; but as such is not the case, it is required to do away with the counteraction of the magnetic poles on the needle, so that it should be directed invariably towards the same point. In my humble opinion, the mode that is proposed in the last number of your REGISTER for ascertaining the *dip*, would likewise prevent the *variation* of the needle.—I am Sir,

Your humble servant,

D. THOMAS.

P. S. As the magnetic needle is of vital importance in navigation, I hope that some of your intelligent correspondents will give their opinion on the subject.

WORKING SHIPS' PUMPS.

To the Editor of the Mechanics' Register.

Sir—Without supposing for a moment but that Mr. Lewthwaite considered himself as being the original inventor of what he calls in your last Number, " a new method of working ships' pumps," I beg to say, that five or six years ago, when I was on the committee at the Society of Arts, I recollect a plan, similar in all respects to his, being laid before them by Capt. Burton, of the Royal Navy, for which, I think, he had the Isis medal, and if so it will be found recorded in the Society's Transactions.

If I recollect right, his plan was to have wheels, which were so contrived as to be capable of being shipped over the side of the vessel, or unshipped in a few minutes when wanted. By means of a bevel-wheel fixed on the center of the shaft (similar to Mr. L's,) it was made to work into another which was fixed to the bottom of a capstan, which was upon deck. Round this capstan an endless rope being passed, which was carried by blocks round the deck of the ship. The crew by laying hold of this rope, and marching in a circle round the deck, worked the paddles, which were represented to be of infinite use in a calm, either when applied to work the pumps, to bring a vessel into action, or to take her from a harbour into a roadstead, to be ready when a breeze sprung up to proceed to sea.—The other application of this invention was the same as Mr. Lewthwaite's, viz. when a ship springs a leak at sea, it is generally owing to the working and opening of the butts and seams during a gale; Capt. B's contrivance was then simply to place the capstan out of gear, hook on the cranks, and place the ship before the wind. The force of the gale in driving the ship through the water, would work the paddles, and consequently the pumps. And thus when running before a gale she could not face, she would keep herself free, and save the exertions of the crew.

Government (I believe) made several experiments with Capt. B's apparatus in taking men of war out of Portsmouth Harbour down to St. Helen's, which perfectly succeeded; but having now adopted and placed steam boats at the different naval arsenals for that purpose, I fancy it has fallen into disuse. Its utility however at sea for the other purposes mentioned, is not to be questioned.

Your obedient servant,

Marchmont-street. HENRICUS.

To the Editor of the Mechanics' Register.

Sir—Your correspondent G. T. P. in your last number, wishes to be informed of the cause why hay stacks, when put up in a damp state, take fire. But in order to understand this, it will be necessary for him in the first place to know, what causes *Fermentation*, or *Chemical action* between certain bodies, when brought into contact with each other—viz. the greater affinity, or attraction which certain of their constituents have for each other, than with the bodies with which they happen to be combined, causing them to unite and form a new compound. If this action becomes rapid, a high temperature is quickly produced, and, if the substances acted upon are combustible, they in consequence take fire.

What raises the temperature and causes the phenomenon in this instance, is the water; this substance, which formerly was thought to be a simple element, is now known to be a compound and to have for

its constituents, *oxygen* and *hydrogen gases;* the one the greatest feeder, or supporter of combustion, and the other the most inflammable of the gases that are known. Without *caloric*, (or heat,) they assume the solid form of ice; but mixed with caloric, which is termed the caloric of fluidity they form water. When water then becomes decomposed, by the abstraction of one of its constituents (oxygen for example), a quantity of caloric is set at liberty, and by this means the temperature will become increased, until the hydrogen and other combustibles are inflamed. When free access of air however is admitted, and which in this case is to be obtained by leaving sufficient openings through the stack at its formation, this accident never happens; as the water then, instead of being decomposed, will be suffered to escape in the former vapour.

Yours respectfully,

HENRICUS.

QUERIES.

No. 40.

What is the process of making Carmine in powder, such as is sold at most respectable chemists?

No. 41.

Also the method of mixing Gamboge *properly*, so as to be fit to paint a yellow colour on smooth glass for the magick lantern. A. S.

No. 42.

What are the proportions of sulphate of copper, sweet spirit of nitre, tincture of steel, and warm water, requisite to form a mixture that will brown gun barrels.

H. WATSON.

No. 43.

Having had the first volume of the LONDON MECHANICS' REGISTER bound, the impression of the title-page appears upon the portrait of Dr. Birkbeck. Are there any means of extracting the impression, and restoring the engraving to its former appearance? T. O.

ANSWERS TO QUERIES.

QUERY, No. 19, page 31.

SIR—In answer to TYRO'S Query, No. 19, I think the following method of preparing a *Hortus Siccus*, or dry garden will answer his purpose. If Sir, you are of the same opinion, you will oblige me by its insertion in your valuable REGISTER.

I remain, Sir,
Your obedient and humble servant,
HENRY WM. DEWHURST.

21, Francis-st. Tottenham-court-road.

DIRECTIONS FOR PREPARING DRIED PLANTS FOR A HORTUS SICCUS.

The plants being laid down in their natural position, as far as possible, upon some sheets of blotting paper, are covered with two or more sheets of the same, and a board being laid upon the whole to prevent the leaves, &c. from curling up, weights are put upon the board, and the whole exposed to the air in a dry place. If the stalks or any other parts of the plants are very thick, the lower part may be pared, so as to lay the whole as flat as possible. The paper is to be changed every two or three days, and the weights increased until the plants are thoroughly dry. A number of plants may be submitted to the same press at once, placed one upon another, with two or three sheets of blotting paper between them, and when dry may be pasted into books.

Instead of flattening the plants for the purpose of placing them in books, they are sometimes dried in their natural form, by suspending them in a tin box of sufficient depth; then carefully filling the box with sand, and placing it in a warm dry place for a few days; after which the sand is to be taken out carefully, and the dry plants may be either made into nosegays and covered with glass shades, or stuck in pots, and scented with a few drops of a proper essential oil: even mushrooms may be dried under sand in a similar manner. The sand should be rather coarse, that the moisture may evaporate the more freely.

QUERY, No. 20, Page 31.

If Mechanicus will fold a sheet of blotting paper into a number of folds and place it on the spot of wax and then apply a hot iron or poker to the paper the wax will be absorbed by the paper. A SUBSCRIBER.

QUERIES, No. 38, Page 96.

AGRICULTURE.

Sir—Seeing some agricultural queries proposed by W. H. in your highly valuable REGISTER, I have been induced to attempt answering them, in the hope that if I err against the principles of chemistry or Geology, sciences with which, I am sorry to say, I am unacquainted, I shall be set right by some of your numerous scientific friends.

First—Soils are, I believe, generally divided into four sorts: the *sand loam*, the *clay*, the *chalk*, and the *gravelly* soils. The clay soil is always in our part of the country (Wiltshire,) termed *stiff* and *sour*; that is, difficult to work. The sand loam and some of the gravelly soils we should call good strong land, that is capable of

bearing good crops, but not stiff or difficult to work. The chalk soils are invariably light, as well as some of the gravelly.

Second—Wheat, beans, and rye, grow best on strong good land; in fact beans will not grow at all on light land. Barley, pease, and oats, grow equally well, though of course the crops are not so abundant on light soils; the finest samples of barley are grown on gravelly soils.

Third—There is little land in this country I believe, capable of bearing two crops of perennial grain in succession. Generally speaking, a crop of wheat once in four years is as much as can be expected without impoverishing the land. By *rotation of crops*, then, is meant, (I speak of the Four-field System) that as a farmer has this year a crop of *wheat* on a portion of his land, the following year he will perhaps sow *barley* or *oats*, as it suits him; with which is generally sown *rye grass* and *clover*, which does not attain maturity till the next spring, when it is either eaten off by the sheep, or cut for hay. It is ploughed up the next winter; lies fallow through the following summer; or since the improved turnip system has been adopted, after having been manured, bears a crop of turnips this summer, and at the fall is sown again with wheat. The utility of rotation of crops will be obvious; the farmer divides his land into four portions, on one of which he has a crop of wheat, on a second a crop of barley, on a third a field of grass, and on the fourth a crop of turnips, or a portion to be manured. Observe, I speak of the system generally adopted about us; but so much depends on the nature and situation of the soil, that it is impossible to give any thing more than a general outline. Some extraordinary good lands will produce a crop of wheat after beans, and that every third year; and there is a great deal of land in cultivation that will rarely, if ever, produce a crop of wheat. This is sown sometimes with oats, pease, turnips, or grass for sheep.

Fourth—I am not geologist enough to answer this question in its extended sense; but from the circumstance that the hills are generally found the most barren and unproductive; and the valleys the most fertile; I should be inclined to suppose that the rains have in a measure washed the productive soil into the valleys.

Fifth—I have never heard of any other expedient than that of well manuring them; though I may venture to assert that the farmers would be glad to be made acquainted with some cheaper and better mode.

Yours, &c.

A YOUNG FARMER.

QUERY, No. 27, Page 96.

PROPERTIES OF THE POLYPE.

Sir,—In answer to the query, No. 27, of your correspondent, W. H. as to what are the properties of the polype, I think he will find the following are some of the principal. The polype is a small aquatic being, found during the summer months in great abundance adhering to the pieces of wood, or leaves, which are floating on the surface of stagnant waters, and to which they generally fix themselves by the tail. Its body which varies in length from a quarter to an inch and a half, consists of a single tube, furnished at one end with long arms, in some cases five or six times the length of the body, to the number of six to twelve, according to the class to which it belongs. It has, as far as we can perceive, neither head, heart, nor intestines of any kind. Its mouth which is situated at the fore part of the body, in the middle between the arms, assumes different appearances according to the different purposes of the animal; sometimes it is lengthened out, sometimes closed, and at others quite hollow. And if examined in either of the two last cases by a microscope, a small aperture may be discovered. The mouth opens immediately into the stomach, which is a kind of bag of the whole length of the body, and may be seen by the naked eye when exposed to a strong light. The manner in which they catch their prey is by extending their arms in every direction, and whenever any small worm, or insect, comes within the reach of any of them, it is immediately seized, and by the contraction of the arms brought to the mouth, where it is soon devoured. The transparency of the body permits us to see the food in the stomach, which gradually loses its shape; it is at first macerated, and when the nutritious juices are extracted from it, the remainder is discharged by the mouth; and I have heard of instances in which the animal having swallowed a small fish, its body has assumed the shape of the fish, owing to its elasticity. As they devour a great deal of food at once, so also they can fast for a long time. The skin which incloses the bag and forms the stomach, is the polype itself; so that the animal consists of but one skin, disposed in the form of a tube open at both ends, and whatever be the organization of this wonderful animal, here it must reside. Here must all the operations which are necessary for its growth and nutrition and its various motions be carried on. It has, as far as our observation has hitherto gone, no dis-

tinction of sex, and the natural way in which they produce their young is this: In summer some small knobs appear to be shooting out of their sides, which grow larger and larger every day, and after a short time they take the figure of a small animal, in every respect resembling its parent, and when sufficiently grown to be separated, they each appear to give a sudden jerk and become divided from one another. From the foregoing remarks we should consider this being only as an animal, possessing all the properties of one: but with a little more attention we soon discover that it also possesses all the properties of a vegetable at the same time; for, like many plants, it may be propagated by slips and pieces cut off from the parent; and what is truly astonishing, that the very means by which we destroy other animals, by cutting them to pieces, tends to the increase of these, for every piece, however minute, will, in a short time become a perfect polype, and has the power of producing all the organs necessary for its existence. There is, perhaps, no phenomenon in all natural history more astonishing than this, that we should have a kind of creative power placed in our hands, which we may exercise at pleasure, and out of one life make as many as we please, each formed with all its functions and powers as complete as that from which it derives its existence. Reaumur informs us that the first time he divided one of these animals into two parts, and saw two perfect animals produced from them, he could hardly believe his eyes; and though he repeated the experiment a hundred times, and observed a hundred more, he could not make it familiar to him. Two or three different species of the polype may be grafted together and they will all grow and form one; and if we draw a small one up the stomach of a larger one, it will still thrive until they become united; proving to us that though they have the power of dissolving their food, they cannot act upon each other.

Some sorts may even be turned inside out like a glove and yet live and act as before. These are only a few of the properties of this truly astonishing animal, but as I fear a description of any more of them would take up too much room in your valuable REGISTER, I must be satisfied with them. I conclude with observing that there is no creature in existence more worthy of our close inspection than the one before us; not only because it so widely differs from all others, but because it may also be justly said to be *the union of the Animal and Vegetable Kingdoms.*

Yours very respectfully,

Southwark. G. P.

We have never received the article on Capillary Tubes, alluded to by R. N. Perhaps he will have the kindness to favour us with another copy. We feel much obliged to him for his excellent Letter on English Grammar, inserted in the present number, and shall be happy to receive his promised communications.

We have attentively perused the plans suggested by Mr. FRANCIS for the establishment of Maternal Institutions; but while we give him full credit for the laudable motives in which it originated, we are of opinion that his proposition is at present premature. The period is, perhaps, not far distant, when his object may be accomplished; but at the present moment, from the multiplicity of business which engages the attention of the Committee of the London Mechanics' Institution, we conceive that they could not, with propriety, cooperate in any measure which is not specifically pointed out by the Rules of the Society. For these reasons, we reluctantly decline the insertion of Mr. F.'s communication, which will be returned to him on application to the Publishers.

F. C. has our best thanks for the trouble he has taken. The remainder of his answers will, in all probability, appear in our next number.

We fear "A MECHANIC" has not sufficiently considered the subject upon which he has addressed us. The Institution cannot accomplish impossibilities; and however disposed the Managers may be to extend the Elementary Schools, their exertions must necessarily be circumscribed by their means. That the Schools will be enlarged as the funds increase, we have no doubt; but prudence requires that this augmentation should take place progressively.

Mr. MALO's inventions will be noticed next week.

H. CAMPBELL's Query has been already inserted, and, we have reason to hope, will shortly be answered.

JUVENIS ADMIRATOR is under consideration.

HENRICUS on cleansing chimneys by machinery is intended for insertion.

We trust the apprehensions of G. M. C. will be completely removed by an article in our present number.

Several other communications have been received, and will be disposed of as soon as possible.

From the lateness of the period at which we received Mr. JAMES's letter, we are obliged to postpone its insertion till our next publication.

Our correspondents are requested to observe, that it is impossible for us to insure the insertion of communications in the current week's number, except they are transmitted on or before TUESDAY.

We should recommend to "A NOVICE," Parkes's Rudiments of Chemistry, published by Baldwin and Co. as a work completely adapted to his views.

LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communications *(post-paid)* are requested to be addressed.
Sold by SHERWOOD, JONES, & Co., Paternoster Row; and may be had of all Booksellers and Newsmen.
Also, Sold by A. & W. GALIGNANI, No. 18, Rue Vivienne, Paris; C. WILEY, New-York; CARFRAE, Rio Janiero.

THE LONDON
MECHANICS' REGISTER.

" Where are the pillars that support the skies ?
" What more than Atlantean shoulder props
" Th' incumbent load? What magic, what strange art,
" In fluid air these ponderous orbs sustains?
" Who would not think them hung in golden chains?
" --- And so they are ; in the high will of Heaven,
" Which fixes all ; makes adamant of air,
" Or air of adamant ; makes all of nought,
" Or nought of all ; if such the dread decree !

Dr. Young.

N°. 36.] SATURDAY, JUNE 18, 1825. [Price 3*d*.

IMPROVEMENT IN MURRAY'S STEAM ENGINE VALVES.

Fig.1

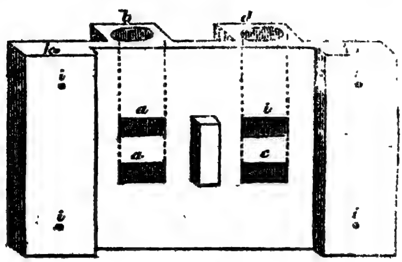


Fig.2

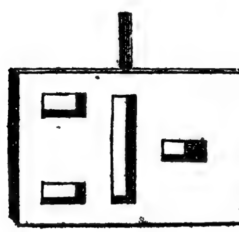
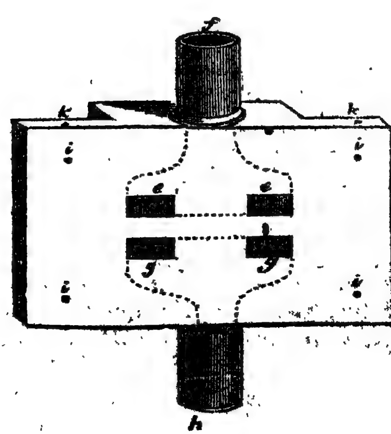


Fig.3



IMPROVEMENT IN MURRAY'S STEAM ENGINE VALVES.

To the Editor of the Mechanics' Register.

Sir—With thanks for the attention shewn to my last communication I send a description of an alteration (an improvement, I trust) which I have made on the Steam Engine Valves of Murray. Should it in your estimation be worth publication, a corner for it in your instructive and amusing miscellany will add to the obligation conferred on, Sir, your obedient servant,

Vauxhall, June 13. S.

Fig. 1, represents that part of the valve into which the slide (fig. 2) fits, but which is removed from its place to shew the position of the holes *a a* and *c c* and their communication with the boiler and condenser by pipes from *b* and *d*. The holes *e e* and *g g* (fig. 3) lead by *f* and *h* to the opposite ends of the cylinder. The slide being in its place, the faces of fig. 1 and 3 are brought together, and screwed at *i i i i*, and then by elevating and depressing the slide, a passage is opened alternately with the boiler and condenser, and top and bottom of the cylinder. To effectually prevent the escape of steam, it may be necessary to fix caps over the parts where the edges of the slide would otherwise be exposed, which may be screwed at *k k*, one of these caps having a stuffing box for the slide rod to pass through.

N. B. I have a working model with the valves on this construction, and find it answer every expectation.

LONDON MECHANICS' INSTITUTION.

MR. LEWTHWAITE'S EIGHTH LECTURE ON ELECTRICITY.

MAGNETIC EFFECTS OF ELECTRICITY—ITS EFFECT IN DISTURBING THE POLARITY OF THE MAGNETIC NEEDLE—COMMUNICATION OF MAGNETISM BY ELECTRICITY—ANALOGY BETWEEN ELECTRICITY AND CALORIC—MEDICAL ELECTRICITY—INFLUENCE OF POINTS—CONCLUSION.

WEDNESDAY, JUNE 8.

MR. LEWTHWAITE introduced the subject of the present evening's lecture by observing that in tracing to its origin that branch of the science of Electricity which relates to its magnetic effects, we find that Dr. Franklin, in enumerating the points of resemblance between lightning and electricity, remarks, that they both possess the power, not only of reversing the poles of magnets, but of destroying the magnetism altogether. Beccaria repeated the experiments of Franklin, and found that lightning always gave polarity to the magnetic needle, and to all bodies that have any iron in their composition; and by observing the way in which these poles lie, he was enabled to ascertain the direction in which they were struck by lightning. Hence he conjectured, that a regular and constant circulation of the whole mass of the electric fluid from north to south may be the cause of magnetism in general.

The most accurate experiments, however, on the magnetic effects of electricity were made by Van Marum, with a battery of 135 jars, containing 130 square feet of coated surface, and with watch-spring needles from three to six inches long. When the needle was placed horizontally in the plane of the magnetic meridian, the north end of the bar acquired north polarity, and the south end south polarity, in whatever way the shock was communicated.

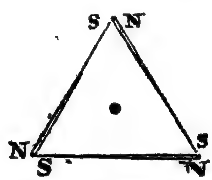
Van Marum made his experiments about the year 1798; since which nothing was done by which a connecting link between the two sciences could be formed till it was revived by M. Oersted, Professor of Natural Philosophy, and Secretary to the Royal Society of Copenhagen, who has been engaged in inquiries respecting the identity of chemical, electrical, and magnetic forces; and as early as 1807 proposed to try "whether electricity the most latent had any action on the magnet." At that time no experimental proofs of the peculiar opinions he entertained were known; but his constancy in the pursuit of his subject, both by reasoning and experiment, was well rewarded in the winter of 1819 by the discovery of a fact, of which not a single person besides himself had the slightest suspicion; but which, when once known, instantly drew the attention of all those who were at all able to appreciate its importance and value. It was not the lecturer's intention to enter into all the discoveries recently made by means of voltaic electricity in connection with magnetism, particularly as that subject had recently been so ably illustrated by the worthy and respected President, but merely to point

out those magnetic experiments which relate to electricity, properly so called.

Mr. Lewthwaite then suspended a magnetic needle on its centre below a horizontal brass wire, in such a manner that when the needle was at rest in the magnetic meridian, the direction of the wire coincided with it. His object was to shew that common electricity, like voltaic electricity, would have the effect of disturbing the polarity of the needle, and making it deviate from the plane of the magnetic meridian. To render this effect visible at a distance, Mr. Lewthwaite attached two pith balls to the poles of the magnet, and having formed a communication between the conductor of the electrical machine and the horizontal wire, he passed the spark along it, when the north pole of the needle was instantly inclined towards the east; in which direction it was deflected till it reached an angle of nearly 90°. Thus it is evident, that though the brass wire possesses no magnetism itself, when electricity is passed along it, the magnetism of the needle becomes disturbed. If the needle be placed above the horizontal wire, a similar deflection occurs, but in the contrary direction. Perhaps he was incorrect in stating that the brass wire possessed no magnetism, for possibly all bodies were magnetic, though there was more difficulty in rendering their magnetism sensible. The members had seen, during the experiments in voltaic electricity, that other metals as well as steel had been made to attract iron filings, which was a convincing proof that they were rendered magnetic. Mr. Barlow is of opinion that the electric fluid in passing along the wire, disturbs its magnetism, which goes off in a tangential form, and this hypothesis is corroborated by several experiments. To render the tangential force more intelligible, Mr. Lewthwaite exhibited a diagram, in the centre of which was a circle, supposed to represent on a large scale, a section of the wire cut transversely. A number of tangents were drawn from different parts of the circumference of this circle to shew the direction in which the magnetism is thrown off.

The electrical battery was then constructed on the lecture table, and Mr. Lewthwaite proceeded to exemplify the communication of magnetism by the electric shock. A sewing needle, which was previously dipped into iron filings to shew that it was not magnetic, was placed upon the table of the universal discharger, and a piece of very fine silver wire (similar to that which he had deflagrated in a former lecture) was placed above the needle and parallel to it. The wire being connected with the poles of the universal discharger, the shock of the battery was passed through it, and the lecturer then shewed, by dipping the needle again into the iron filings, that by this longitudinal arrangement, no magnetic effect was produced upon it; but if the silver wire was placed across, or at right angles with the needle, the passage of the electric spark would communicate polarity to it. This arrangement was accordingly adopted, and upon passing the shock through the wire in this position, it was instantly rendered magnetic, and attracted the iron filings very powerfully. It was also shewn, by presenting the eye and the point of the needle successively to the magnetic needle, that the eye had acquired north, and the point south polarity; and the lecturer observed that if the needle had been placed above the wire, the contrary effect would have been produced.

Mr. Lewthwaite then performed one of Sir Humphry Davy's valuable experiments, by placing three needles upon a card in the form of an equilateral triangle, as represented in the following diagram:—



A silver wire was passed through the centre of the card, and attached at each end to the knobs of the universal discharger. The spark was then passed through the wire, and the whole of the needles instantly became magnetic, the eyes acquiring north, and the points south polarity, as distinguished in the figure. The same effect would have taken place if 20 needles had been employed instead of three, and the lecturer considered these experiments as affording a strong confirmation of Mr. Barlow's tangential theory, as it was evident that when the electricity was directed longitudinally, no magnetism was elicited; but when the wire was placed across the needles, they were immediately magnetized.

If magnetism can be thus communicated by passing the electric shock through a wire which crosses the needle but once, it follows that the effect will be more powerful if a wire is bent cylindrically, or in the form of a helix; as in this case the wire crosses the needle many times, and instead of one tangential force, there will be as many as the number of coils which surround the needle placed within the helix.

Mr. Lewthwaite then suspended a helix of this kind between the poles of the universal discharger, and placing a sewing needle in it, he passed the spark through the helix from a jar of the usual size, which he observed was sufficiently powerful to shew the effect of the experiment. The helix first employed was right handed, and the eye of the needle being nearest the jar, acquired north polarity; but when the experiment was repeated with a left-handed helix, the contrary effect was produced, and the eye of the needle became endued with south polarity. Mr. Lewthwaite converted several other needles into magnets in a similar manner, and shewed they possessed nearly sufficient power to support each other's weight.

May we not apply these experiments to the magnetism of the earth itself, and infer that the electricity generated by the sun at the torrid zone, throws off its magnetism at right angles, and causes it always to act in the direction of the poles? We know that by means of the prism, light is decomposed into seven primitive colours, and it is found by experiment that small particles of steel placed in the violet ray, become magnetic. An analogous effect therefore may possibly be produced in nature by the sun's rays. Dr. Thomson has observed that there seems to be a close analogy between caloric and electric matter. "Both of them" says he "tend to diffuse themselves equally—both of them dilate bodies—both of them fuse metals—and both of them kindle combustible bodies. I do not mean to draw any other conclusion from these facts, than that electricity is very often concerned in the heating of bodies, and that probably some such agent is employed in accumulating the heat produced by friction. Supposing that electricity is actually a substance, and taking it for granted that it is different from caloric, does it not in all probability contain caloric, as well as all other bodies? Has it not a tendency to accumulate in all bodies by friction, whether conductors or non-conductors? May it not then be accumulated in those bodies which are rubbed against one another? Or if they are good conductors, may it not pass through them during the friction in great quantities? May it not part with some of its caloric to those bodies, either on account of their great affinity or some other cause? And may not this be the source of the caloric which appears during friction?" These sentiments were so completely in accordance with the lecturer's own feelings, that he thought he could not do better than to communicate them in the writer's own words.

Previous to entering upon the subject of medical electricity, Mr. Lewthwaite read a letter he had received by the post from a member of the institution, detailing an experiment which he had witnessed during a lecture on electricity, in which the lecturer exhibited the effect of the fluid in the production of vegetation, by sowing some mustard seed in the presence of the audience, and causing it to grow to the height of an inch in a few seconds by passing the electric spark through it. Not having been able to obtain any information from the lecturer, except that he had chemically prepared the seeds, the writer requested that Mr. Lewthwaite would explain the phenomena. The whole of this gentleman's communication is so exactly similar to a letter transmitted to us about three months ago, from a correspondent signing himself "GEORGIUS," and inserted in our first volume, page 333, that we have no doubt both letters were written by the same hand.

In reply to this letter, Mr. Lewthwaite intimated his suspicion that there was some deception in the experiment. He was aware that electricity possessed great power in the promotion of vegetation, but he could not conceive it possible that by any combination of chemical and electrical agency, vegetables could be made to grow with the extraordinary rapidity described by the writer. He should, however, devote his attention to a further consideration of the subject, and if he should succeed in his investigation, he would communicate the result of his experiment to the members through the medium of the MECHANICS' REGISTER.

On the subject of the application of electricity to medical purposes, it was merely the intention of the lecturer to show the various modes of administering it, without entering into any discussion of its utility or effects. He was not a medical man, and as he had only administered electricity now and then among his own friends (he believed beneficially), he begged to refer those who desired further information to Mr. Carpue's work on medical electricity, in which they would find the subject very fully elucidated. The following are the various modes in which electricity is administered, viz.

1. To cause a current of electricity to pass through a patient to the ground;
2. To cause the current to pass through a patient from the ground to the conductor;
3. To condense electricity in a patient;
4. To exhaust electricity from a patient;
5. To pass the aura, or breeze, to a patient;
6. To draw the aura from a patient;

7. To pass sparks to a patient;

8. To draw sparks from a patient;

9. To pass and draw sparks at the same time to and from a patient; and

10. To pass shocks through any particular part of a patient.

Mr. Lewthwaite then observed, that he should be happy to exemplify these different methods of administering electricity, if any one of the members would be kind enough to act as the representative of the patient. The lecturer's invitation was accepted by a gentleman of the name of PEAKE, who ascended the platform, and acted the part of the patient very patiently, while Mr. Lewthwaite went through the whole of the ten divisions. The operation of most of them was extremely mild, and produced no perceptible effect; but when the lecturer arrived at the latter divisions, and began to pass sparks into different parts of the patient's face, some involuntary distortions of the muscles occurred, which, from their comical appearance, had the effect of communicating motion to the risible muscles of the whole audience. Previous to passing the shock through the patient's arm, to illustrate the tenth method of communicating electricity, Mr. Lewthwaite observed that by means of the striking electrometer, the operator could regulate the shock according to the circumstances of the case, so as to make it either strong or weak. ("Weak, if you please," said Mr. Peake.) The shock was then passed through the arm several times, and the convulsive motion by which it was agitated at every repetition, satisfied the spectators that the shock was sensibly felt, and was confined to the arm alone. Mr. Peake, having thus performed his part in a very kind and satisfactory manner, bowed to the audience and withdrew amidst loud applause.

After describing the construction of the electrophorus, an ingenious instrument invented by the celebrated Volta about the year 1774, Mr. Lewthwaite proceeded to illustrate the influence of points. If a point is attached to the conductor of the machine, and a lamp is held near it while the cylinder is turned, the aura or rush of electricity from the point bends the flame from its perpendicular direction. The lecturer exhibited this effect, and observed that by some writers it was attributed to the air at the point being put in motion, but from the effects produced by the electric fluid in a vacuum, he was not of that opinion. A point has the effect of conducting the electricity off in a silent stream, while a knob always produces a snap and a spark. A jar furnished with a point can be charged much quicker and easier than with a knob, and this fact shews the superior advantages of pointed conductors. The lecturer then placed two jars, one furnished with a knob, and the other with a point, at an equal distance from the conductor, and charged them both at the same time; but upon applying the discharging rod, a strong spark was drawn from the pointed jar, and a very weak one from the other. To shew the influence of points in another manner, Mr. Lewthwaite charged a jar, and by applying a point slowly to the knob, discharged it silently and effectually.

The influence of points was further illustrated by several interesting and pleasing experiments. A revolving motion was communicated to a small cross, furnished with points bent at right angles at the four extremities, and turning upon an axis. As the electric fluid passed off at the points, the little apparatus received an impulse which caused it to run up an inclined plane, in a direction contrary to that of gravity. An electrical orrery was then produced, which was also put in motion by the influence of points, and gave an ingenious representation of the motion of the earth round the sun, accompanied by the moon performing its revolution round the earth. A float wheel was also made to revolve rapidly by placing it between the poles of the universal discharger, and afforded a further proof of the principle stated by Mr. Lewthwaite in a former lecture, viz. that the electric fluid passes from the interior to the exterior of the Leyden jar. He had also stated that the experiment performed by igniting camphor, between the positive and negative conductors, in order to prove that the fluid passes from the former to the latter, is of a fallacious nature, because during the combustion of some other substances under similar circumstances, the flame assumes the contrary direction; and the repetition of the present experiment with the float wheel afforded a more satisfactory illustration of the direction of the fluid, which fell upon the floats as it passed from the positive to the negative conductor, and communicated a rapid motion to the wheel.

The concluding experiment was of a very interesting kind, and was performed with a glass tube, dotted spirally with tinfoil! To the top of the tube was attached a revolving cross furnished with points, and the room being darkened, the fluid was communicated to the apparatus, when the luminous electrical column appeared in rapid revolution, and presented an extremely beautiful spectacle.

Mr. Lewthwaite then observed that he had intended to conclude by enumerating the whole of the subjects illustrated during the present course of lectures, but as he had already exceeded the usual time, he should omit this recapitulation, which was the less necessary, as the members had an opportunity of perusing them at their leisure, in that excellent periodical, the MECHANICS' REGISTER. He would therefore merely observe in conclusion, that since the late important discoveries in Electricity, matter has been found to possess qualities which the philosophers of an earlier period were not aware of; and that in all probability, matter differently modified, or under different circumstances, may possess properties which are yet undiscovered.

Let this consideration spur us on to fresh exertions in the cause of philosophy; and if, after all, we are obliged to confess ourselves purblind and ignorant in a great degree, let us not despair, for religion points out to us a cheering prospect;—she directs us to a period when all our faculties shall be expanded, and all our enquiries satisfied;—

"When GOD's Almighty hand shall lift the curtain high,
"And all Creation's wonders open to our eye!"

The plaudits which followed the worthy lecturer on his withdrawing from the lecture table, sufficiently proved that the members properly appreciated the perspicuity and ability with which he had illustrated the important science of electricity during the course; and a further instance of his kindness was afforded by Dr. BIRKBECK, who announced that on the following Wednesday Mr. Lewthwaite would deliver a lecture on the Blow-pipe, particularly the oxyhydrogen Blow-pipe; an instrument which was extremely interesting, not only from its scientific application, but from its intimate connection with the arts.

MR. WALLIS'S THIRD LECTURE ON ASTRONOMY.

ATMOSPHERICAL REFRACTION AND REFLECTION—TWILIGHT—PHENOMENA OF GRAVITY—COMPOSITION OF FORCES—MR. FERGUSON'S APPARATUS—PLANETARY MOTION—PRECESSION OF THE EQUINOXES—PHENOMENA OF THE TIDES—LUNAR AND SOLAR TIDES—SPRING AND NEAP TIDES, &C.

FRIDAY, JUNE 10TH.

Mr. WALLIS commenced the Third Lecture of his excellent course on Astronomy, by stating that the principal subject to which he should direct the attention of his hearers this evening would be the phenomenon of the *tides*. He should, however, defer the illustration of this branch of the science till the latter part of his lecture, and begin by elucidating the nature and effects of *atmospherical refraction*.

Having already stated that *twilight* is occasioned by the *refractive* power of the atmosphere, combined with its *reflective* properties, it is necessary to observe, that the natural course of a ray of light, as it passes through the regions of space, or through any medium of uniform density is in a straight line. But if it passes out of one medium into another of *different density*, it becomes *refracted*, or bent out of its previous course, except it fall *perpendicularly* upon the medium. Thus if a ray of light passes from air into water in a perpendicular direction, it preserves the same direction; but if it falls upon the surface of the water *obliquely*, or at any angle from the perpendicular, it is bent from its original course. If a stick is put into water obliquely, it appears crooked, in consequence of the rays of light passing to the eye out of a medium about 880 times more dense than the atmosphere. For the same reason, if we look at the sun when it is rising, it does not appear in its true place; but if we look at a star in the *zenith*, the rays of light reach us in perpendicular lines, as they undergo no refraction, and the star is seen in its true place in the heavens. It follows therefore that if the heavenly bodies are seen in any part of the heavens except in the zenith, the rays of light are bent out of their course by the refraction of the atmosphere, and they are not seen in their true situations.

When the sun is in the horizon it appears about half a degree above it, for it is seen by the rays of light which proceed from it, and all objects appear in the direction in which the rays strike the eye. Thus, continued Mr. WALLIS, if I look at a distant lamp, I see it in its true place; but if a mirror was placed in such a direction as to reflect the rays of light towards me, I should see a reflected image of the lamp in the mirror, and should refer the object to the direction in which the rays fell upon the eye. It is owing to this circumstance that we see the sun in the horizon when we know it has not yet arrived there. The lecturer then exhibited a large diagram, representing a portion of the earth's surface, with the atmosphere surrounding it. By this diagram, which shewed the manner in which the sun's rays

are refracted on passing through the atmosphere, it was seen that they strike the eye in horizontal lines some time before the sun is actually in the horizon; and as all objects are referred to the direction in which the rays strike the eye, the sun appears rising at an earlier period than it is in reality above the horizon.

Another effect resulting from the refractive power of the atmosphere, is that the light of the sun approaches and recedes *gradually*; for if no atmosphere existed, it would be seen as brilliant at the moment of its setting as at noon-day, and the transition from light to darkness would be instantaneous. This fact is another proof that the more we investigate the sublime science of Astronomy, the stronger is our conviction of the infinite wisdom of the Great Artificer of the Universe, who has furnished our planet with an atmosphere, and thus obviated the fatal effect which would otherwise be produced upon the organs of sight, by the sudden change from brilliant sunshine to total darkness. Some time before the sun reaches the point at which the refraction of its rays makes it appear in the horizon, the upper part of the atmosphere is illuminated by his beams, which are scattered in every direction by the *reflecting power* of the atmosphere, and produce the fainter light called *twilight*, which precedes his rising, and succeeds his setting.

Mr. Wallis here observed, that the important fact that we always refer objects to the direction in which the rays of light proceeding from them fall upon the eye, accounts for our seeing objects *upright*, though their images are *inverted* on the retina of the eye. If, said the lecturer, I touch the top of this lamp, I know it is the *top*, though on the retina its image is at the *bottom*, but as the rays which render it visible proceed in an upward direction from the lower part of the retina, and as the object must be seen in the direction in which the ray falls upon the retina, it necessarily appears at the top; and the ray proceeding from the bottom of the object to the upper part of the retina for the same reason, will necessarily be referred downwards. If therefore the images of objects were *upright* on the retina, they would be seen *inverted*; but as their situation is *reversed* on the retina, they appear in their true position, or *upright*.

The lecturer now proceeded to illustrate the phenomena of *gravitation*, by which term is meant the tendency which all bodies possess to fall towards the earth. This tendency is accounted for on the principle that all matter attracts matter, and as the whole mass of the earth is so much greater than that of the bodies on its surface on which its attraction is exerted, they are necessarily attracted, or fall towards it. It is not supposed that there is at the centre of the earth a *magnet* which exercises this attraction, but that it results from the greatness of its entire mass. In confirmation of this opinion, it has been found that the immediate vicinity of a high mountain has the effect of preventing the plumb-line from acting freely, and deflecting it from its perpendicular direction. This was proved by an experiment performed by Dr. Maskelyne, at the mountain Schehallien, in Perthshire, who found that on the south side of the mountain the plumb-line was attracted towards the north, and on the north side towards the south. From this experiment it was evident that the perpendicular attraction of the whole mass of the earth was in some degree counteracted by the horizontal attraction of the mass of the mountain. A similar effect was observed by Mr. Cavendish to result from the attraction of a large mass of lead.

By the laws of gravity, its force decreases inversely as the squares of the distances of bodies increase. If we suppose the Creator to have communicated motion to the heavenly bodies in a certain direction, they would continue to move in right lines for ever, if not acted upon by the force of gravity in another direction, and the actual motion of the planets in their orbits results from the combination of these two forces. The ball upon the lecture table possesses no tendency to move, but remains at rest by its own inertia; but if it once be put in motion, it would continue to move in the direction of the force impressed upon it, if it met with no resistance. But by the force of gravity it has a tendency to fall towards the centre of the earth with an *accelerated motion*, and the velocity of this motion increases as the squares of the times occupied in its fall. It is found that a body passes through 16 feet and a fraction in the first second of its fall, and to ascertain the distance through which it will fall in three seconds, the number of seconds is squared, and the initial velocity multiplied by the product. Thus the square of 3 is 9; and the initial velocity 16, (omitting the fraction) multiplied by 9, is equal to 144, the number of feet the body would fall through in three seconds of time.

To elucidate more fully the composition of forces, and their application to planetary motion, Mr. Wallis first directed the attention of his audience to a diagram in the form of a parallelogram, and shewed upon mechanical principles, that if a body

was impelled *horizontally* by an *equable force*, or a force by which it described equal spaces in equal times, while another equable force acted upon it *vertically*, the body, partaking of both the forces, would proceed in a right line between the two, and describe the diagonal of the parallelogram. The motion resulting from the composition of two forces acting at right angles to each other, will therefore be *rectilinear*, provided the forces are *both equable*. But if one of the forces is *uniform*, while the other is *accelerated* the resulting motions will be *curvilinear*. This was very clearly illustrated by another diagram, in which the *equable* or *uniform* force acted horizontally, while the *accelerated* or *gravitating* force acted vertically, and it was seen that a body acted upon by the two forces must necessarily describe a curve. This, the lecturer observed, is the principle upon which all planetary motion depends.

Mr. Wallis now exhibited to the audience Mr. Ferguson's admirable apparatus, for the purpose of enforcing by positive proof, the arguments from which he had deduced the *rectilinear* motion resulting from the different combinations of forces which he had particularised. Mr. Ferguson's beautiful mode of demonstrating this fact consists of a square frame, into which a moveable board was fitted, so as to slide backwards and forwards. At one of the angles of the board an ivory ball is placed on a wire, suspended by a thread to a pulley which moves with the board, and the construction of the apparatus is such, that while the ball is moved horizontally by drawing out the moveable board, it is also moved perpendicularly by the thread which passes over the pulley. The apparatus having been properly adjusted, Mr. Wallis gradually drew out the board, and the effect of the two equable forces was strikingly exemplified by the motion of the ivory ball, which described exactly the *diagonal* of the square.

The effect of the composition of *uniform forces* being thus demonstrated, Mr. Wallis introduced an original machine to exhibit the combined operation of *uniform* and *accelerated forces*. To effect this, the thread by which the ivory ball was attached to the apparatus was made to pass round a cone, and as the horizontal motion of the board unwound the thread from the cone, an *accelerated* motion was communicated to the ball, which, in accordance with the principles inculcated by the lecturer, described a *curved line* upon the moveable board. Mr. Wallis observed, that by varying the proportions of the cone, curves of different kinds might be produced; but it was sufficient to shew that *curvilinear* motion necessarily results from the composition of *equable* and *accelerated* forces.

Newton has shewn, in his great *Principia*, that supposing the moon to be acted upon by the force of gravity which diminishes in the inverse ratio of the square of her distance from the earth, she would fall through the same space in the first *minute* of her descent, that a falling body at the surface of the earth describes in the first *second*. And this is found to correspond with her actual motion; for the line she describes in her motion round the earth deviates from the tangent of her orbit about 16 feet in one minute of time. In this small space of time, the effect of the earth's gravity is not taken into the account.

Another diagram upon a large scale was then exhibited, for the purpose of applying the principles already laid down, to the actual motion of a planet in its orbit, and proving that the composition of the uniform and accelerated forces must cause it to describe an ellipsis. In this diagram, the sun was represented in the focus of a large ellipses, and it was shown that if the planet was projected with an equable force in a right line, as soon as the accelerated force of gravity began to act at a right angle with this force, the planet would begin to describe the curve of an ellipsis round the sun, and proceeding with an accelerated motion, would approach nearer and nearer to the sun till it reached the opposite point of its orbit. Upon arriving at this point, the increased momentum acquired by its accelerated motion would counteract the increased attraction now acting upon it in consequence of its greater proximity to the sun, and as it described the other half of its orbit, it would gradually recede from the sun, and proceed with a retarded motion till it completed the elliptical figure, when the same motions would recommence. The elliptical orbit of the planet was described within an exterior circle on the diagram to show its form more distinctly, and a number of radii proceeded from the sun and intersected the ellipsis in different points. The successive triangles formed by their radii, and the portions of the elliptical orbit which they respectively contained, were stated by the lecturer to be of equal area, as it is a property of planetary motion, that the planet describes equal areas in equal times.

Another beautiful instance of the effects of a combination of forces is the precession of the equinoxes. In ancient maps of the heavens, the sun, at the period of the vernal equinox in March, appears in the first point of the constellation Aries, but it

is not found in the same place at that period now, in consequence of the precession of the equinoxes, by which the longitude of the stars has become changed. Mr. WALLIS explained this intricate subject by means of an appropriate diagram, and in a more familiar manner, by assimilating the motion of the earth on its axis to that of a peg-top when spinning. While the top spins perfectly upright, a point on the top of its surface will be directed to the zenith of the heavens without any deviation; but when the top is falling, a combination of forces takes place, and if we imagine a great circle described horizontally on the walls of the lecture-room to represent the ecliptic, the revolving point on the equator of the top will intersect every part of this circle in succession.

Mr. WALLIS then explained the mode of ascertaining the distance of the earth from the sun, by observing the transit of the planet Venus over his disc from different parts of the earth's surface, by which means the sun's angle of parallax is found, and the proportion which the diameter of the earth bears to its whole orbit is determined. The circumference of the orbit being found is multiplied by 7, and the product divided by 22, which gives the diameter; and half the diameter is the radius of the orbit, or the distance of the sun from the earth, which is 95,000,000 of miles.

Having thus shown the effect of gravity in the regulation of planetary motion, Mr. WALLIS stated that he should now proceed to elucidate the phenomena of the tides, in which the operation of gravity differs very materially from what he had already described. The tides are principally occasioned by the attraction of the moon, though, from the smallness of her size, compared with that of the sun, her total attraction is not a hundredth part of the sun's. As however the moon is so much nearer to the earth, her comparative distance from the top and the sides is sensibly different, and the effect of her attraction on different parts of the earth's surface is more perceptible. But the sun is placed at such an immense distance, that its attraction has not so great an operation as a disturbing power, though a much greater as a total effect. This distinction should be borne in mind, lest the greater effect of the moon's attraction in producing the phenomena of the tides should seem to contradict the general principles of gravity. The proximity of the moon to the earth is therefore the sole cause of the sensible difference in her attraction on different parts of its surface.

After these introductory remarks, Mr. WALLIS withdrew for a few minutes to prepare his transparent apparatus, for the purpose of rendering more intelligible the effect of the moon's attraction in producing the tides. The first transparency represented the Northern Hemisphere, the whole circumference being surrounded by the waters of the ocean, which were elevated on each side of the circle, and depressed at the top and bottom, so as to circumscribe the earth with an elliptical figure, and to represent the period of high water at opposite points of its surface. As the moon was supposed to be situated on the left of the figure, the lecturer observed that though her attraction acted upon all parts of the earth, its effect was the greatest on that portion of the surface which was at the least distance, and the waters were consequently raised on that side, while they were drawn from the more distant parts at the top and bottom of the hemisphere. But there are two tides in every 25 hours, and therefore when the waters are raised on that part of the earth's surface which is nearest to the moon, they are also elevated at the same time on the opposite side of the earth; and to account for the occurrence of two tides at the same time on opposite sides of the sphere, it must be recollected that as on that side of the earth which is most distant from the moon, her attraction acts with the least force, the waters will consequently be more elevated there; and also that the centrifugal force arising from the earth revolving about the centre of gravity acts upon that side of the earth, but not on the side which is nearest to the moon, which accounts for her raising the tide to the same height on opposite points of the surface of the earth at the same time.

All the observations made by the lecturer on the production of tides by the moon's attraction, are applicable also to the attraction of the sun, which operates in a manner exactly similar, but in a less degree, on account of his immense distance, and having thus explained the general principles of the tides by the transparency already exhibited, Mr. WALLIS prepared a second which displayed in a very beautiful manner the motions of the earth and moon, and the influx of the tides on successive portions of the earth's surface. In this transparency, the moon was seen revolving round the earth, while the earth revolved on its own axis, and both revolved round their common centre of gravity, which is situated just within the circumference of the earth. The effect of these various motions was extremely striking, and the machinery by which they were produced must

have been adjusted with admirable precision. The earth, as in the preceding figure, was surrounded by the water in an elliptical form, and as the moon revolved round it, the fluid mass progressively changed its situation, so as uniformly to exhibit at the same time the appearance of high water on that part of the earth's surface which was nearest to the moon, and at the opposite point of the earth's circumference. The motion of the earth on its axis and about the centre of gravity in this diagram also conveyed a distinct idea of the effect of the centrifugal force in contributing to the elevation of the indirect tide on the opposite side of the earth, while her attraction produced the direct tide at the point nearest to her.

Previous to an illustration of the joint effects of the sun and moon in producing the tides, Mr. WALLIS alluded to some local circumstances which, at first sight, appear to contradict the theory by which these phenomena are accounted for. The tides do not in all places ebb and flow in direct conformity with the motions of the moon, and the periods at which the tides occur in the River Thames afford an example of this deviation. Mr. WALLIS here exhibited a transparent map of Great Britain, and pointed out the three great currents which are produced by the local situation of the British Dominions. One of these currents passes to the North of Scotland and returns through the German Ocean; another passes between Great Britain and Ireland, when its effect as a tide is lost in consequence of the numerous projections it encounters; and the third pursues its course through the British Channel, and by the time it reaches the mouth of the Thames, meets the tide which has passed round the Eastern coast of the kingdom through the German Ocean. Two tides pass round in this direction, while one flows through the Straits of Dover, so that the tides at London Bridge are not produced by the direct influence of the moon's attraction, but are the consequence of the tides which occur in the German Ocean, and the swell produced by their confluence with the tide in the British Channel.

The next transparency exhibited the earth surrounded by the waters as before, together with the sun and moon in opposition, or at the period of the full-moon. In this situation as the attraction of both luminaries is exerted in the same line, and each produces both a direct and an indirect tide, the waters rise higher at the opposite points of the earth's surface which are most exposed to their influence, and spring are occasioned. The moon then moved through one-fourth of her orbit, and upon arriving at her quadrature, her attraction was exerted at right angles with that of the sun, and as the two forces were now opposing each other, the effect of the moon's attraction was in some measure diminished, and the result was the production of neap-tides. The moon again moved forward in her orbit, and approached the sun till the period of the new moon, when they were in conjunction, and their joint attraction being again exerted in the same line, spring tides were again produced, by the co-operation of the direct and indirect tides of the moon and sun. In this transparency also, the elliptical mass of waters changed its figure with beautiful precision, as the moon changed its position with respect to the earth.

The last transparency was of the most magnificent description, and displayed the twelve signs of the zodiac on the circumference of an extensive circle, within which the moon was seen revolving round the earth, while both revolved on the common center of gravity. The spectators were supposed to be placed at an immense distance above the northern hemisphere, and watching the ellipsis of waters which followed the moon in every part of her orbit, while to a spectator on the surface of the earth, the moon's course might be traced during the month through all the signs of the zodiac, like that of the sun in the course of the year. While this splendid scene was exhibiting, Mr. Wallis observed that there was probably no tide at the poles, and that the average height to which the joint attraction of the sun and moon raised the waters in the open ocean was about eight feet. He also introduced a number of interesting remarks on the varieties which, from local causes, occur in the periods and elevations of the tides in different parts of the world, and concluded his lecture amidst the rapturous applause of an audience crowded to excess.

LIVERPOOL MECHANICS' INSTITUTION.

On Wednesday the 8th instant, a numerous and highly respectable meeting was held in the Music Hall, at Liverpool, for the purpose of establishing a Mechanics' Institution in that important and populous district. The chair was taken by Mr. Alderman Case, and the proceedings of the meeting were of the most gratifying description. Dr. Traill, the Rev. A. Wilson, Mr Yates the secretary, Mr. Currie, and several other gentlemen of the first respectability addressed the crowded assembly, and proposed a series of resolutions, which

were all unanimously adopted, and a committee was appointed to carry them into effect.

In the course of the evening, the following letter was read from the Right Hon. W. Huskisson, one of the representatives of Liverpool, in reply to a request from the provisional committee that he would take the chair at the meeting. We have no doubt our readers will participate in the satisfaction we have experienced from the perusal of so flattering a testimonial in favour of Mechanics' Institutions, from one of his Majesty's ministers; particularly as that gentleman, from some recent proceedings in the House of Commons, has been supposed to entertain sentiments inimical to the interests of the operative classes:—

"Somerset-place, May 21, 1825.

"SIR—I have to acknowledge the receipt of of your letter of the 17th instant, in which you state that, as chairman of a meeting lately held at Liverpool, you have been requested to express the wish of that meeting, that it might consist with my public duties, and private convenience, to take the chair at a general meeting of the inhabitants, proposed to be held, for the purpose of taking into consideration the expediency of forming a Mechanics' Institute in that town.

I have no difficulty in stating, that I consider institutions of this nature as likely to be attended with beneficial results both to artisans and the public, if properly regulated, and directed to those objects to which such institutions ought, in my opinion, to be limited; I mean, to the teaching of such branches of science as will be of use to mechanics and artizans in the exercise of their respective trades. It is under this feeling, and with this view, that I have taken an interest in the society originally formed at Edinburgh, for the education of mechanics under the title of "the School of Arts," the regulations and proceedings of which I would take the liberty to recommend to your notice.

"I regret, however, to say, that, from the present state of public business, and the avocations which are likely to press upon me after the session of Parliament, I see no chance of having it in my power to name any time when I could go down to Liverpool. I must, therefore, beg permission to decline the honour proposed. In so doing, I cannot refrain from expressing how much I am gratified by the liberal view which you take of the individual efforts of his Majesty's Ministers to foster the arts, and to promote the general diffusion of knowledge; as well as by the considerate and friendly motive which induces you to urge the flattering request of the meeting over which you presided.

I have the honour to be, Sir,
Your most obedient humble servant,
W. HUSKISSON.

Samuel Hope, Esq Chairman, &c. &c.

The receipt of this letter suggested the following resolution, which was carried with the greatest applause, and we beg to add our sincere wish that the right hon. gentleman will fulfil the expectations of the meeting by complying with the request it contains:—

"That this meeting has received, with great satisfaction, a communication from the Right Hon. Wm. Huskisson, expressing his cordial approval of the principles and objects of this and similar institutions; that the meeting recognizes in this communication, the disposition manifested by him on all occasions to foster the arts, and promote the diffusion of useful knowledge. It is, therefore, requested, that the chairman will convey to him the earnest desire of the meeting, that he would accept the office of President of the Liverpool Mechanics' Institute."

Mr. Egerton Smith read a letter which he had addressed to Dr. Birkbeck, requesting information on the subject of the London Mechanics' Institution; and also laid before the meeting an admirable answer from the worthy Doctor, in which he pays a handsome tribute to the members of the metropolitan establishment, for the unabated interest evinced by them in the proceedings of the institution, and expresses his best wishes for the success of the proposed institution at Liverpool.

The cordial thanks of the meeting were voted to Dr. Birkbeck for his unwearied exertions in promoting the scientific instruction of the working classes; and from the spirit of unanimity which characterised the proceedings of the assembly, consisting of upwards of a thousand mechanics, and gentlemen friendly to their interests, we can entertain no doubt of the complete success of their united exertions.

To the Editor of the Mechanics' Register.

SIR,—In your report of my second lecture on Astronomy, at page 98 of your Register you have confounded the remarks in which I pointed out the distinction between the *synodic* and *sidereal* periods of the moon. It should read thus:

The period in which the moon completes her revolution round the earth is called her *sidereal* revolution, and consists of twenty-seven days and one-third; but owing to the revolution of the earth and

moon annually round the sun, she does not complete a revolution with respect to the sun in less than twenty-nine and a half days, the period of a lunation or synodic revelation.

At page 100 the reference was to the eclipse of 1820, in which I stated there was a favourable opportunity for viewing the irregular limb of the moon on the sun's disc, you have inadvertently called it the moon's shadow.

On the same page, at the top of the second column, it should be read "some bright spots which have been seen occasionally on the dark part," &c.

Line 25 in the same column, should be read "nearly as bright as the moon *when seen rising by daylight*."

In the same column the last paragraph is confused. The moon's libration in longitude (of which I treated) arises from the unequal revolution in her orbit, while her rotation is uniform, which occasions her eastern and western limbs to present a kind of oscillatory motion to and from her centre—this is only an optical appearance.

There are some others of minor importance, which are so obvious, as that the reader will correct them for himself.

I must, Sir, trouble you to notice these in your next number. I am quite aware, from the great length of time the lecture room is darkened, and the excessive crowding, that your reporter must be placed under the greatest disadvantage in following lectures consisting so much of what is argumentative.

I remain, Sir, with respect,
Yours, &c.
JOHN WALLIS.
Alfred-place, Albany-road, Camberwell.

LECTURES FOR NEXT WEEK.

Wednesday, June 22, the lecture for this evening is not yet determined upon.

Friday, June 24, Mr. WALLIS at the request of the Committee, will deliver a fifth lecture on Astronomy.

AEROSTATION.

To the Editor of the Mechanics' Register.

Sir—By inserting the following, if you think it worthy of a place in your excellent publication you will greatly oblige

Your very humble servant, B. R.

Merely as a suggestion, not being able to say practically I offer the following as an improvement in the art of aerostation. We know that to cause the descent of a balloon, the volume of gas must be decreased, which is done by suffering a quantity to escape through the valve, and irrevocably losing it; and to ascend again the only means resorted to, is to lessen the burden on the balloon, by throwing out ballast, of which a plentiful supply must be taken; thus alternately losing *gas* and *ballast*.

Now I propose a copper vessel containing, for instance, a cubic foot, and capable of resisting pressure from within, to be placed in the bottom of the car and a compressing syringe or small forcing pump, as light as possible, attached to it, from which let an elastic gun tube (similar to that connected with the new stomach pump but larger) be carried into the midst of the gas in the balloon, and suspended by strings from the upper part. My idea is that by working this pump with a moderate force, the gas may be drawn from the balloon and compressed into the copper vessel; and if I am rightly informed, the portable gas lamps usually contain at least 30 volumes. If so, would not an equal decrease of volume be sufficient to cause a descent, and of its increase, by again admitting the gas restore the power of ascending? B. R.

UTILITY OF CARBONIC ACID GAS IN EXTINGUISHING FIRES.

To the Editor of the Mechanics' Register.

Sir—As numerous experiments are being made by Sir Humphry Davy upon the same principle, though with a different application, I am advised to publish a method I invented of extinguishing fires in dwelling houses by *carbonic acid gas* in the spring of 1823, to establish the same, and accelerate the progress towards public utility. I should therefore be obliged if you will insert this letter in your valuable columns, that it may be subjected to the analysis of public opinion, and thereby its true nature and value known.

The scheme has not any claims to originality in principle but only in mode of application: It is rather surprizing that some method has not been devised hitherto for the employment of carbonic acid gas in these casualties, as its effects are so palpable. The chemical character of this gas is its great specific gravity; the strong affinity of its components; and its incompatibility with life and flame. It can be obtained in any quantity of calcination of limestone, combustion of charcoal, fermenting vats, &c. and therefore an objection on these grounds cannot be sustained. I find that when the gas is impelled on burning charcoal, paper, wood, burning oils or spirits, especially in a circumscribed space, they are instantly extinguished; but when I sub-

stitute an equal stream of *water*, the *surface only* of the paper or wood pile is put out. From such facts any person must immediately perceive the great superiority of an elastic fluid for this purpose. It instantly applies itself to the burning surface, and displaces the common air. The closer the house is made by stopping the window with wet blankets, the greater will be the salvation of property; but the more eminent advantages of this plan operate before the fire has risen to great strength, or before the house has fallen in. The objections to the use of water are moisture, generation of steam, formation of hydrogen, whereas to this none of such objections are applicable; and as to its being fatal to life, no one I conceive would approach so near as to incur the risk, for I find that if atmospheric air be contained only one third, it will not support combustion, at least in the lower parts of the model house. It would be an additional security against the preading of the fire to fill the neighbouring houses with carbonic acid gas, and this would effectually prevent ignition taking place.

The method I propose for the transmission of this gas, is first to *condense* it in large copper globes, one or more in number, (say perhaps 40 atmospheres) which being seated on a carriage of ordinary construction, with a leather tube, it might be drawn about by horses in the usual way, and directed into the second floor window, or into those places where the flames raged most violently. A large number of the spheres might be kept ready under condensation at the company's store room, to act on any emergency, and these vessels might be charged by a large engine at the gas work out of town. It would be no ill store for shops of valuable merchandize to keep one ready in the shop or cellar to tap in such an emergency. Fron the corroborative experiments I have made on combustion, in reforence to the preventive power of carbonic acid gas I am pretty confident of its snccess, and I am led to hope some one who has more leisure will adopt those experiments which alone can lead to a decision against it or in its favour.

I am, Sir,
Your obedient servant

29, Thavies Inn, WALTER G. JAMES.

ON THE DIPPING NEEDLE.

To the Editor of the Mechanics' Register.

Sir—Having observed in your useful publication, the MECHANICS' REGISTER, of the 4th instant, (page 77) some observations on the Dipping Needle, and as you there express a desire to have my opinion of your worthy correspondent's notions on the subject, it would betray much want of good manners to refuse a reply. I have only one principal motive for hesitation, which arises from difference of opinion from him; but it is not opinion, but the truth we want to find, and this being the case all objections vanish. It will not be needful here to insert his ideas and description, as they may be seen by a reference to his communication. The gentleman in the first place (I presume) greatly errs, by supposing that the south pole of our globe, attracts the south pole of the needle, for it is well, (and I was going to say universally) known, that poles of the same name even repel each other. His second argument runs thus, viz. that each pole counterbalances the other, and that the dip is only the difference in the counteraction of the poles. Now poles do not counteract each other in that sense, but each pole has two opposite properties, so that while it draws down by attraction one end of the needle, it draws up the other by repulsion, and both conspire to make the dip perfect with the magnetic meridian; something resembling the air in a ventilator, which has opposite directions, so that while the foul air passes out, the pure comes in through the same passage; but this I confess is a faint representation. The phenomenon of the magnetic virtue, perhaps is so perplexing, and hitherto inexplicable only by reason of its exquisite simplicity; and therefore the knowledge of the origination of magnetic attraction is not to be expected so much from the learning of the schools, as from some favoured individual who looks out of his book, and applies to his long neglected mother nature. Of her he may learn haply, that iron is the ground of the loadstone, the loadstone being fired, or to speak a little more correctly, the salt of mars being fired, causes that streaming flame which becomes the magnetic meridian, and guides the needle to the poles. There is but one means however, in nature, to ignite the salt of mars, and that was performed on the nucleus of the earth, which is the principal magnet, before it was taken into the solar system, or the earth had from its Creator received its full bulk, &c. &c.

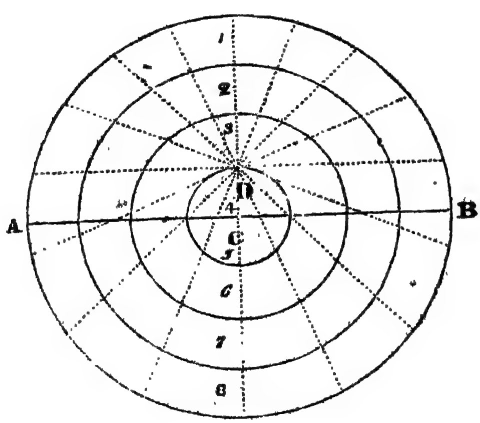
I am, Sir,
Your greatly obliged and humble servant.
WM. POPE.

11, Ball-alley, Lombard-street.
June 18, 1825.

MOTION OF A CANNON BALL TOWARDS THE CENTER OF THE EARTH.

Sir—I had the gratification of being present at the first lecture delivered by Mr. WALLIS to the members of the LONDON MECHANICS' INSTITUTION, and I cannot sufficiently express the pleasure I experienced at the very perspicuous and novel manner in which that gentleman explained the form, and the several motions of the earth; the splendid illustrations of the phenomena of the seasons, and other interesting matters relating to the sublime science of ASTRONOMY.

There was, however, one hypothesis stated by Mr. Wallis, in common with other distinguished lecturers, on which I beg leave, with great deference, to offer a few observations. Mr. Wallis said, "if it were possible to bore a tunnel completely through the earth, a cannon ball dropt into it, would not pass through, but being carried by its momentum nearly to the opposite surface, would return, and again passing the centre, would continue to vibrate backwards and forwards till it ultimately remained immoveable at the centre." Now, Sir, I doubt whether this effect would take place; for as it is generally admitted that bodies do not gravitate to the centre of the earth from any particular cause of attraction residing there, but from the circumstance that all the particles of matter of which the earth is composed possess the power of attraction, I should imagine that when the ball had descended a considerable distance towards the centre, the portion of the earth, through which it had passed, attracting it in an opposite direction to its descent, would check the accelerated motion, and the body in its approach to the centre would become lighter and lighter till it arrived, by a very slow motion, at the centre, where it would possess no weight being equally attracted in all directions, and would not pass the centre. Perhaps the following diagram will assist in illustrating my opinion.



Let the circle A B represent the earth, C the centre, the spaces between the concentric circles to be each one-eighth of the diameter, or 100 miles. When the ball arrives at the point D, I conceive the force of attraction would act upon it in the manner represented by the right lines from the point D to the circumference of the circle. The ball would, in this situation, be attached by a force equal to three pounds from which it first began to descend, and by a force equal to five to- the centre; the ball would consequently, in my opinion, become lighter, and its accelerated force concentrated and decreased, in proportion as it proceeded towards the centre. When arrived within a mile of the centre, it would be attracted by forces in opposite directions so nearly equal, viz. 3999 and 4001, that it would possess scarcely any motion or weight, and when arrived at the centre would lose both, and remain there stationary. Should you think the above worthy a place in your interesting miscellany, it is much at your service.—Your sincere well wisher,

T. S.

Oxford-street.

QUERIES.

No. 41.—HARD AND SOFT WATER.

From the little knowledge I possess of chemistry, I think that if two bodies, whether aeriform, liquid, or solid, are in *any way* different, there must be a *chemical* difference. Impressed with this idea, I should be glad to know from some of your correspondents the exact difference between *spring* or *hard water* and *soft water*. The knowledge of this would account to your readers for the preference given to each for different purposes. S. M. T.

No. 42.

Sir—Allow me to ask, through the medium of your widely extended REGISTER, whether the earth does not in itself contain the principle of vegetation? for if we dig many feet below the surface of the earth, and expose it to the atmosphere, it will in a short time be covered with weeds. I am aware that seeds will lie dormant many years, but by what possible means could they reach so low?

A YOUNG FARMER.

ANSWERS TO QUERIES.

Volume 1, page 127.

RAIN FALLING UPON A BUILDING ON FIRE.

Rain coming on during a fire may either increase or decrease it, but I certainly conceive it can do neither to an extent of any moment. The rain which falls will unquestionably not merely fall into "*flame*," but will fall upon red hot substances and no doubt can hence remain that a portion will be decomposed, giving *oxygen* to the red hot substance, and *hydrogen* to the flame; which must certainly increase the fire, were it not that some portions of that rain will fall on bodies in the neighbourhood of the red hot substances, which will be hot enough to vaporize without being hot enough to decompose; and as steam is extremely powerful in suppressing combustion, the ill effects of the hydrogen supplied to the fire will by the red hot substances decomposing the rain, be nearly or quite paralyzed. And as those bodies in the vicinity of the red hot ones become wetted, the fire cannot so rapidly spread among their particles. Rain therefore, in my opinion, is more likely to check than increase the fire. F. C.

Volume 1, page 143.

"What air or gas do vegetables generate?"

Vegetables *during their growth* absorb carbonic acid gas, which is formed in nature by combustion, respiration, fermentation, &c.; And *they generate oxygen gas.*

Vegetables *during their decomposition, generate carbonic acid gas with hydrogen*, and most likely some other gases, according to their peculiar constitution, and *they absorb oxygen gas.*

N. B. I am aware this has been before answered, but I think not so fully as the enquirer must have wished. F. C.

Volume 1, page 127.

"OUTSIDE OF A DECANTER COVERED WITH MOISTURE."

The answer of J. L. B. to the above query (Vol. 1, page 143) is improperly worded. Who ever heard of an atmosphere "condensed into steam?" or indeed of any thing being "*condensed*" into steam.

Steam may be condensed into water; and water may be converted by heat into steam; but condensation is the opposite of rarefaction: It is the act of reducing in volume. The atmosphere can be purified by heat, but cannot be condensed into a fluid by any known degree of cold; nor indeed by any other means. The true answer therefore to the query of G. L. is this; the atmosphere surrounding the decanter being warmer than the water poured into it, a portion of the aqueous vapour, *contained in the atmosphere* imfringes against the outside of the vessel, has its heat abstracted, becomes consequently condensed, and forms water. F. C.

Volume 1, page 190.

STAY SAILS.

I cannot particularize the *use* of stay sails, but their name is derived from their being fixed on ropes called stays, which cross from mast to mast, *staying* them in their places.

QUERY, No 23, page 62.

CAPILLARY TUBES.

SIR—In the 42nd No. of your instructive REGISTER, a question is asked concerning the different appearances of the surfaces of *water* and *mercury* when suspended in Capillary Tubes.*

Your correspondent is probably aware that the phenomenon of capillary attraction is now accounted for by supposing that the exterior film of the liquid within the tube is attracted and raised above the general surface by the influence of the interior part of the tube, and the interior parts of the

fluid are supported by the attraction of the exterior.

If the bore of the tube be large, the weight of the central parts of the fluid will so far overcome the attraction of the inner surface of the tube, that the fluid within and without the tube will continue level.

When *water*, *acids*, or *oils* are employed, the surface within the tube is *concave*, because the mutual attraction of the particles of those fluids *is less* powerful than their attraction for the glass.

On the contrary, when a very dense fluid, as *mercury*, is used, the surface is *convex*, because the mutual attraction of the particles of mercury is *more* powerful than their attraction for the glass.

This effect seems analogous to that produced by placing portions of mercury and water on a smooth plane, the parts of the *water* cohering but slightly, will be diffused, but the *mercury* will assume and retain a spherical form. I am, Sir,

Yours respectfully, J. P.

QUERY, No. 23, Page 62.

CAPILLARY TUBES.

Sir—In answer to Mr. Thos. Taylor, who wishes to know why mercury or any other liquid contained in a Capillary Tube or Barometer, has its upper surface sometimes concave, and at other times convex; the reason I believe is this, that owing to the capillary attraction to the sides of the tube when the mercury rises, the centre is pushed forward in its motion upwards, and would proceed much quicker, were it not held back by the attraction to the sides, the surface is then necessarily *convex*, and vice versa, for the same reason when the mercury falls it becomes *concave*.

I remain, Sir,

Your obedient servant,

HENRICUS.

QUERY, No. 23, Page 62.

CAPILLARY TUBES.

Whatever may be the cause of water rising higher inside a Capillary Tube than the bulk into which it is plunged, I conceive the convexity which is observed arises from the *repulsion* of the glass: a repulsion which I have commonly seen shewn to exist by a person filling a cup or glass *above the rim*, the edges of the glass repelling the water so much, as to enable you to do so to a considerable extent. And it might be mathematically shewn, that the water being so repelled, could by possibility assume no other shape, and so of mercury. F. C.

CORK MECHANICS' INSTITUTION.

We are happy to hear that this Institution is proceeding in the most prosperous manner. It consists already of 500 members, and the subscriptions amount to 2000*l*. The library contains 250 volumes, and is daily increasing in addition. Lords Shannon, Kingston, Bandon and Carbery have kindly consented to become Vice-presidents. The Hon. J. Abercromby, M. P. has presented the society with 50 copies of Mr. Brougham's Pamphlet on the Education of the people, which are to be distributed among the different trades. But the most distinguished gift of all, was that of Thomas Deane, Esq. Architect, who granted to the Institution the use of a theatre, for which he had been offered 200*l*. per annum by the patentee of the Dublin theatre. We understand that gratuitous courses of lectures, will shortly be delivered in this theatre, by Mr. EDMUND DAVY, lecturer to the Cork Institution, on the science of chemistry; and by Mr. HAMBLIN on the mathematics.

TO CORRESPONDENTS.

We are again compelled, by the great influx of communications, to defer the performance of our promise to M. MALO.

The observations of "A LOOKER ON" are intended for insertion as soon as possible.

We shall feel great pleasure in adopting the suggestion of N. R.

The communications of TYRO MECHANICUS, R. YELLOW, Mr. DEWHURST, Mr. HOLLANDS, S. P. Henricus, and several other Correspondents are unavoidably postponed for want of room.

ERRATUM.—In the letter on English Grammar in our last Number, page 106, col. 1, line 43, for "the point which he assumes as, at least, doubtful," read "the point which he assumes as settled, is, at least, doubtful."

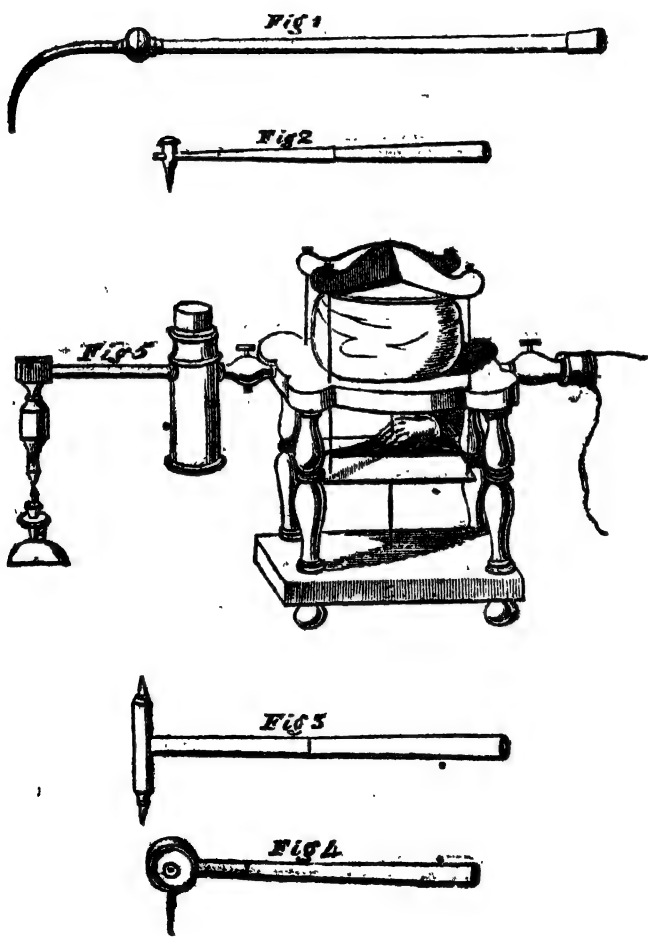
LONDON:—Printed by W. MOLINEUX, 5, Bream's Buildings, Chancery Lane.
Published by COWIE & STRANGE, 24, Fetter Lane, where all Communications (*post-paid*) are requested to be addressed.
Sold by SHERWOOD, JONES, & Co., Paternoster Row; and may be had of all Booksellers and Newsmen.
Also, Sold by A. and W. GALIGNANI, No. 18, Rue Vivienne, Paris; C. WILEY, New York; CARFRAE, Rio Janeiro, &c.

THE LONDON
MECHANICS' REGISTER.

" The first and greatest work of a philosopher, is to try and distinguish appearances, and to
" admit none untried."—EPICTETUS.

No. 37.] SATURDAY, JUNE 25, 1825. [Price 3*d*.

OXYHYDROGEN AND OTHER BLOW-PIPES.



LONDON MECHANICS' INSTITUTION.

MR. LEWTHWAITE'S LECTURE ON THE BLOW-PIPE.

VARIOUS FORMS OF THE BLOW-PIPE—IMPROVEMENTS IN ITS CONSTRUCTION BY CRONSTADT, WOLLASTON, VARLEY, TOFTS, &c.—SPIRIT BLOW-PIPE—OXY-HYDROGEN BLOW-PIPE——GURNEY'S SAFETY-CHAMBER, AS IMPROVED BY WILKINSON——EXPERIMENTS——FUSION OF IRON, PLATINUM, SILEX, &c. &c.

WEDNESDAY, JUNE 15.

Mr. Lewthwaite, whose lectures on Electricity afforded such general satisfaction to the members, delivered this evening a lecture on the Blow-pipe, in which he detailed, in a very perspicuous manner, the various improvements which have been made on this instrument, from its original and simple form to that of the oxyhydrogen blow-pipe.

The blow-pipe, he observed, in chemistry, mineralogy, and the arts, is an extremely useful instrument, and is employed for the purpose of raising an intense heat by the flame of a lamp or candle. It operates by throwing a rapid current of air through the flame, and by this means urging it violently against the object to be heated, which must necessarily be of small size. The blow-pipe is capable of throwing such a heat upon a small object as it would be difficult to obtain for a larger quantity of the same substance in the most powerful furnaces; and with this advantage, that the process is all the time under the inspection of the operator, whereas he can only conjecture what passes in the centre of a furnace.

The stream of air for blow-pipes is usually raised by a blast from the mouth;—in some instances by the vapour of boiling alcohol;—and in others from bellows or other pneumatic machines. To begin with blow-pipes of the first kind, which are the most simple and convenient, Mr. Lewthwaite observed that as persons might not always have access to a metallic blow-pipe, he would shew how easily a glass blow-pipe might be formed which would answer all the purposes of a metal one for experiments on a small scale. The lecturer then took a piece of glass tube, and held it in the flame of a spirit lamp till it became flexible, when he drew it out so as to diminish the diameter of the aperture, and bending it near the extremity, produced a perfect blow-pipe in its most simple or usual form.

The first improvement on the original form of the blow-pipe was introduced by M. Cronstadt, who added a hollow ball to the tube, as represented at fig. 1 in our engraving. The advantage of this addition is that any moisture generated in the tube is collected in the ball, and may be easily emptied out, as the ball is made to unscrew.

Dr. Wollaston's blow-pipe (fig. 2) is somewhat different in its form, and possesses the advantage of being so extremely portable, that it may be carried in the waistcoat pocket, as it is made in three pieces, which fit into each other like the joints of a telescope.

Varley's blow-pipe, (fig. 3) is furnished with two jets one turning each way at the end of the tube, which the inventor imagined would have the effect of lightening the labour of the operator. This blow-pipe also unscrews, so that the moisture collected in it may be readily thrown out.

The next blow-pipe exhibited by Mr. Lewthwaite is represented at fig. 4, and is furnished with a moveable joint at the end, so that the direction of the stream of air can be changed according to the convenience of the operator. This blow-pipe is also made to unscrew, and is very portable.

The *gasometer* used in the performance of experiments in chemistry, also forms an apparatus applicable to the purposes of a blow-pipe. When the gasometer is filled with gas water is poured into the upper part, and the gas issues from the lower orifice in a strong jet, which may be directed against the flame of a lamp in a manner similar to the common blow-pipe; but a single gasometer can only operate with the simple gases, such as *oxygen* or *hydrogen*. If, however, two gasometers are employed at the same time, they may be filled with oxygen and hydrogen respectively, and the two jets being thrown upon the flame, the operator may perform his experiments with the *mixed gases* in perfect safety. Two gasometers were placed upon the lecture table, and Mr. Lewthwaite exemplified the mode in which they may be appropriated to the purposes of blow-pipes, either separately or together.

The lecturer then exhibited a large diagram, representing a *Hydraulic* or *Hydro-pneumatic* blow-pipe, upon a very ingenious construction, invented by a humble artizan named Tofts. This apparatus is of a quadrangular form, and is about half filled with water. A bent tube, furnished with a stop-cock, passes into the water, through which

the air is conveyed, and is afterwards impelled upwards through another tube to the top of the apparatus, where it rushes through a horizontal jet in a continued stream against the flame of a lamp placed to receive it.

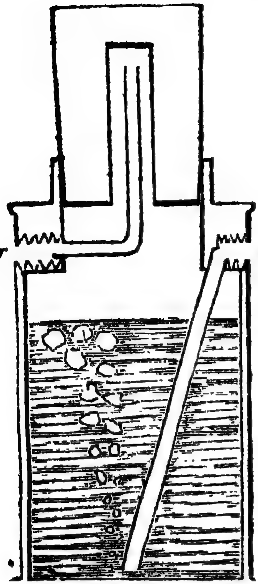
Mr. LEWTHWAITE then proceeded to illustrate the application of the blow-pipe by giving one or two examples of its effects. He first placed a portion of the *oxide of lead*, or what is usually called *red lead*, upon a piece of charcoal, and shewed that by means of the common blow-pipe the oxide could be reduced to its metallic state, and again become lead. In using the mouth blow-pipe, the principal difficulty is to keep up a *constant stream* of air for a considerable time, and the facility of accomplishing this object can only be acquired by practice. The lecturer observed that the best method was to endeavour to keep the cheeks inflated while the air is drawn through the nostrils. He was but an indifferent operator himself, but had seen persons keep up a continual blast for a quarter of an hour together. Mr. LEWTHWAITE then directed the flame of a spirit lamp upon the oxide of lead, and it appeared to us that he succeeded extremely well in preserving a constant current of air for several minutes, till the substance was decomposed by the intense heat, and the original lead was restored, which was evident from its being easily cut with a knife.

The lecturer next operated upon *galena*, or *native sulphuret of lead*, and succeeded with the same facility in driving off the sulphur, and reducing the substance to lead, which was proved by its yielding readily to the knife, whereas the sulphuret is in itself extremely harsh, and effectually resists the edge of the knife. *Charcoal* is one of the best substances that can be used as a supporter to the body acted upon, as it forms a kind of furnace in miniature; and it should be recollected that in operating with the blow-pipe, the greatest heat is concentrated at the point of the blue flame. In reducing the metallic ores, three different fluxes are frequently employed, viz. salt of phosphorus, or the triple phosphate of soda and ammonia;—borax;—and the subcarbonate of soda. It was not his intention to take up the time of the audience by analyzing all the different metals, and for further information on this subject he should refer them to Mr. Children's translation of Berzeluis's Treatise on the Blow-pipe.

After shewing that the metal bismuth is readily fused by the common blow-pipe, Mr. LEWTHWAITE exhibited the spirit blow-pipe, which consists of a vessel about half filled with alcohol, or spirits of wine. Below this vessel a spirit lamp is placed, the heat of which causes the alcohol to boil, and its vapour is then conveyed through a tube fixed in the interior of the apparatus, and terminating in a jet opposite to the flame. The lecturer exemplified the effect of the spirit blow-pipe by holding in the flame a piece of glass tube, which was melted and drawn asunder in a few moments. This instrument produces a powerful flame, and is extremely useful, though rather expensive, from its great consumption of spirits.

Having thus particularised the various forms of the blow-pipe suggested previous to the invention of the oxyhydrogen blow-pipe, Mr. LEWTHWAITE proceeded to illustrate this important apparatus, which was first constructed by Dr. Clark. The two gases, oxygen and hydrogen, are mixed in the proportion in which they unite to form water, viz. two volumes of hydrogen to one of oxygen. Dr. Clark however, recommends rather an excess of hydrogen. His apparatus consists of a strong iron case, into which several atmospheres are condensed by means of a piston; and a jet being fixed to the machine, the elasticity of the mixed gases causes them to rush through the aperture, and to perform the office of a blow-pipe. This apparatus has fallen into disuse in consequence of accidents having occurred by its bursting. The lecturer here exhibited one of these instruments, which was now the property of the Institution, but formerly belonged to Mr. TATUM, and exploded while he was operating with it. Mr. LEWTHWAITE expressed his surprise that Mr. Tatum had escaped with his life, and handed round to the members that part of the apparatus which had burst, as an illustration of the irresistible force with which the mixed gases had exploded.

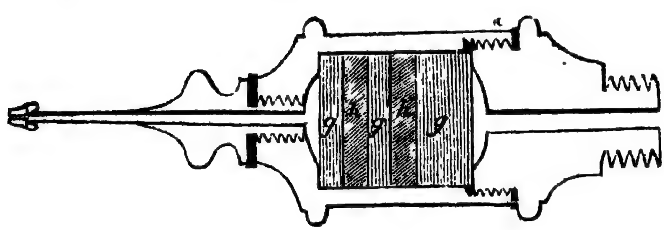
The danger formerly incurred is now completely removed by the improvements in this powerful instrument, introduced by Mr. Gurney. The improved oxyhydrogen blow-pipe, of which fig. 5 in our engraving is a correct representation, was now placed upon the lecture table, and its construction minutely described by the lecturer. It will be seen by the figure, that after the bladder beneath the upper part of the apparatus is filled with gas from the reservoir, the pressure of the operator's hand on the board below, which is attached to the upper part by means of strings, forces the gas from the bladder into the first chamber, a section of which upon an enlarged scale was exhibited to the audience, and is correctly delineated in the following diagram:—



This chamber is partly filled with water, and as the gas passes from the bladder along the tube F, it rises through the water, and from thence proceeds down the bent tube J into the second, or safety chamber. The bent tube is introduced into an opening in the cork, to prevent the possibility of any water splashing into it during the passage of the gas.

The *safety-chamber*, of which the following figure is a section, was also exhibited on a large scale by Mr. LEWTHWAITE, and may either be attached to the apparatus horizontally, or a connecting tube may be added, so as to fix it perpendicularly, as represented at fig. 5 in the first engraving; in which position it was used by the lecturer in his illustrative experiments:—

The safety chamber was invented by Mr. Gurney, and is formed upon the principle of Sir Humphry Davy's safety lamp, by introducing a number of successive layers of wire gauze, as represented at *g, g, g,* for the purpose of preventing the explosion of the gases by the retrocession of the flame. Notwithstanding this precaution, the danger of explosion was not completely obviated, till Mr. Wilkinson of Ludgate-hill suggested the expedient of introducing layers of *asbestos*, about an eighth of an inch in thickness, between the layers of wire-gauze, as at *h, h.* *Asbestos* is known to be an extremely bad conductor of heat, and the intervention of this substance, at the in-



tervals represented in the figure, affords complete protection to the operator in using the oxyhydrogen blow-pipe.

The bladder was first filled with hydrogen gas, to shew the operation of the instrument, and the jet of flame being ignited, the lecturer observed that in cases where a large mass of flame, and an extraordinarily intense heat was required, two or more jets might be directed to the same point, as represented in a diagram which he now exhibited to the members. The bubbling of the water in the first chamber was distinctly heard, as the gas passed through it during its passage from the bladder.

The assistant having filled the bladder with the mixed gases, Mr. Lewthwaite now commenced a series of experiments to exemplify the effects of the intense heat generated during their ignition. The point of an *iron nail* was first exposed to the action of the flame, and was almost instantly fused. A long piece of watch *pendulum wire* was then submitted to its operation, and burnt for a considerable time with great intensity, throwing out an infinite number of brilliant scintillations, similar to those displayed during the combustion of iron in a jar of oxygen gas. *Sponge platinum*, or platinum in its pure and unmanufactured state, was next fused, and a piece of *platinum wire*, about an eighth of an inch in thickness, was afterwards subjected to the powerful heat of the jet. This

is one of the most intractable metals that can be operated upon, yet the intense heat of the flame melted the extremity of the thick wire, though the operation was not continued long enough to make it fall in drops.

Mr. Lewthwaite then endeavoured to fuse some minute fragments of *diamond*, and would doubtless have succeeded, if the force of the jet had not several times blown them from their places on the supports of platinum and plumbago on which they were laid. *Alumina, silex, lime, magnesia*, and other refractory substances, were afterwards fused with great facility, and afforded incontestible evidence of the intense heat produced by the combustion of the mixed gases, oxygen and hydrogen, and the great utility of this important instrument in the prosecution of scientific investigations, and their application to the arts. The light produced during the combustion of lime was of the most vivid intensity, and Mr. Gurney has suggested the idea of applying it to the purposes of illumination. If this could be accomplished, observed the lecturer, the gas lights in use at present would comparatively fade into nothing.

It was the intention of Mr. Lewthwaite to illustrate the operation of the oxyhydrogen blow-pipe by some further experiments, but as it was now past ten o'clock, he trusted the members would excuse him. He had now brought his labors to a conclusion, and he therefore begged to offer to the President and the members in general his sincere thanks for the attention and respect with which they had distinguished his exertions. If at any future time the Society should stand in need of his assistance, he earnestly requested that the Committee of Managers would not be backward in asking it, for the members might depend upon it that nothing could afford him greater pleasure than to have it in his power to promote the interests of the "London Mechanics' Institution."

The kind wishes thus earnestly expressed by the worthy lecturer were answered by the unanimous and enthusiastic plaudits of the crowded assembly, and the strong feeling of gratitude manifested by the members must have convinced him that they were duly sensible of the value and importance of his instructions.

MR. WALLIS'S FOURTH LECTURE ON ASTRONOMY.

ORBITS OF THE EARTH AND MOON—HISTORY OF ASTRONOMY—SYSTEMS OF PYTHAGORAS, PTOLEMY, TYCHO BRAHE, COPERNICUS, &c.—MOTIONS OF THE PLANETS—TRANSIT OF VENUS—SOLAR SYSTEM——MERCURY, VENUS, THE EARTH, MARS, JUPITER AND SATURN

FRIDAY, JUNE 17.

Upon commencing the present lecture, Mr WALLIS observed that since he had the pleasure of addressing his audience, he had been requested by the Committee to extend his course to five lectures, and therefore he should not conclude his illustrations of the science of ASTRONOMY till the ensuing Friday evening. He had hitherto pursued, as systematically as possible, those general topics of astronomy which relate to the earth and moon, and had dwelt upon these subjects at considerable length, in consequence of their being of the most essential importance, and he should now proceed to the consideration of astronomy as a system.

As however, he should deliver another lecture, he wished, previous to the general consideration of the science, to revert to the subject of the moon, particularly as it was difficult to exhibit any thing like a correct representation of the relative proportions of the orbits of the earth and moon to each other. He should be enabled to effect this by means of the ingenious apparatus before him, which was invented by Mr. Ferguson. He had stated that the moon's orbit is elliptical, relative to the earth, but that with respect to the sun it is of a different figure, and traces in space a line which nearly coincides with the orbit of the earth. The principal difficulty is to demonstrate that the moon, as she accompanies the earth in its orbit, herself describes an orbit which is always concave towards the sun, and this difficulty is removed by Mr. Ferguson's machinery. At one end of the apparatus is a white ball, representing the sun, from which proceeds a rod several yards in length, which represents the radius of the earth's orbit. A wheel is placed at the end next the sun, and one at the opposite extremity, which are so proportioned, that when the machinery is put in motion, the wheel connected with the sun causes it to revolve 13 times and one-third round the earth, while the wheel which communicates motion to the earth completes one revolution round the sun. Pencils are fixed in the small wheel, which are at the distance of one four hundredth part of the whole length of the radius from each other, and consequently represent the distance of the moon from the earth, while the whole radius represents the distance of the latter from the sun. As the machinery moves, the points of the pencils describe at the same time on a long sheet of paper the

orbits of the earth and moon with respect to the sun, and it is distinctly seen that though the moon, during her elliptical motion round the earth, crosses the orbit of the latter twice in every month, the line which she describes in her actual motion round the sun, is in every part of her orbit concave towards the sun, as well as that of the earth's orbit. Mr. WALLIS having put the apparatus in motion, the pencils described upon the paper the two lines representing the orbits of the earth and moon, and as the operation proceeded, he particularised the periods when the moon's orbit intersected that of the earth. The paper, which was of great length, was subsequently handed round for the inspection of the audience, and afforded a very satisfactory demonstration of the lecturer's remarks. The two lines so nearly coincided, that they were nowhere more than half an inch apart, and crossed each other at intervals of about 18 inches; but through their whole length, they were both concave on the side nearest the sun.

After the preceding elucidation of this complicated subject, Mr. WALLIS stated that he should now direct the attention of his hearers to ASTRONOMY as a system, and shew that there is such a regular and systematic arrangement of its various branches as to constitute it a science.

The early history and progress of any science is necessarily involved in considerable obscurity, because, as during its infancy its advances are slow, so are its details at first comparatively unimportant, and its conclusions equivocal and unsatisfactory. While this remark is applicable to every branch of physical science, it bears particularly in reference to the investigations of the nature and motions of the celestial bodies. The beauty, splendour and grandeur of the heavens, must have excited the admiration, and employed the scrutiny of man, from the first period of his existence; but as the explication of their phenomena required long and accurate observations, and an intimate acquaintance with the laws of motion, they must for a long period have remained objects merely of his admiration and of his speculative curiosity. We have then nothing that properly speaking can be called a history of the *origin* of ASTRONOMY. But still it can be traced to higher antiquity than any other department of natural science; and for this very obvious reason; that as the elements, or what may be called the *materials* of this science, are specific observations, whose value consists in their comparison after long intervals of time, with similar observations, the secure registry of these facts must have necessarily been seen by the observers to be of vital and indispensible importance. And to transmit them intelligibly to distant periods of time, the most natural and appropriate vehicle would be that of sensible signs or images; and as these would be selected by the natural faculty of our association of ideas, every thing connected with the visible heavens or heavenly bodies, would readily become mingled with the religious notions prevalent, and ultimately, as we find, astronomical facts and truths, become incorporated with the rites and ceremonies of idolatrous nations.

The most remote observations with which we are acquainted are three relating to eclipses of the moon, observed at Babylon in the years 719 and 720 before the Christian era. The Chaldeas or Soothsayers of that once renowned city, are the most ancient astronomers whose fame has reached us. Ptolemy, the Egyptian philosopher, who lived 850 years afterwards, assumes these facts in his determinations of the lunar motions. To a very high antiquity we are able to trace the cultivation of this science among the Egyptians, who were certainly very accurate observers, and to whom we know that Thales the Grecian philosopher was greatly indebted for those truths which he taught in the Ionian school, founded by him about 680 years antecedent to the Christian era. His successor, Anaxagoras, was persecuted by the Athenians for teaching the celestial phenomena by means of established and fixed laws, as they conceived this detracted from the dignity of the gods.

Until about 130 years after the establishment of the Ionian school, astronomy, as a science, consisted almost entirely of a series of facts or observations, including very few deductions from them by which other phenomenon might be elucidated. But about this period Pythagoras, who was an early disciple of Thales, collected these facts, and with the addition of his own observations, and by the energies of his own profound mind, arranged them into a system of beautiful and singular simplicity. He referred the apparent diurnal revolution of the heavens to the rotation of the earth; the earth he considered to be in revolution about the sun, together with all the other planets; and he even taught that the comets in their eccentric motions respected the sun as their centre. And it is a proud trophy to human genius that the first system built when sufficient materials had been collected, presented the beautiful proportions and symmetry of nature! It has survived the cumbersome system of Ptolemy, the intricate and complicated arrangements of the

Egyptian hypothesis, and that of Tycho Brahe; and as illustrated by Copernicus, and demonstrated by Newton and La Place, stands, after the lapse of 2300 years, as a *Pharos* in the broad ocean of human knowledge.

From the time of Pythagoras till that of Ptolemy, a period of about 700 years, astronomy was greatly enriched by the observations and important discoveries of Aristarchus, Hipparchus, and others. The Pythagorean system, however, seems to have been confined to the attention of but a few philosophers, while that of the Alexandrian school, built upon the illusion of the senses, and less intellectual, gained, under the auspices of its inventor, Ptolemy, an extensive and protracted credit

In this system the earth is considered as the centre of motion to the moon, the sun, and all the planets; and to explain the varied appearances of *direct, stationary*, and *retrograde* in planetary motion, a most extravagant and complicated arrangement was imagined; and which for every new fact observed, required some new assumption of imaginary forces. The whole universe was supposed diurnally to revolve around the earth. This unwieldy and conjectural system maintained its credit for more than 1500 years; and which, as it involved many almost absurd doctrines, can only be accounted for by the prevalence of those causes which replunged Europe into darkness.

The Egyptian system, which followed that of Ptolemy, merely adopted a new position of the planets Mercury and Venus, placing them in revolution about the sun, which however, was an important improvement, as it accounted for the fact of these planets having never been seen in opposition to the sun, which, upon the Ptolemaic hypothesis was possible. This arrangement would also explain the *retrograde* and *stationary* appearances of Mercury and Venus, in the most simple manner.

The system which finally removed all the difficulties presented in the motion of the heavenly bodies, was that divulged by Nicholas Copernicus about the year 1520.

This, which, though in its great elements it may be regarded as identical with the Pythagorean, was so much elucidated by the genius of this great man, as to reflect the highest honour upon his sagacity and perseverance. As he attributed to the earth a motion in the orbit, and on its own axis, he was pronounced an enemy of religion, from a false idea that this was in contradiction to some of the statements in the sacred Scriptures. Galileo shared the same fate for corroborating these statements of Copernicus, which he was enabled to do by the aid of the telescope, an invention of this period. The numerous and invaluable discoveries which have been made in the two subsequent centuries, have brought astronomy to a degree of perfection to which nothing but mechanical science can pretend. A few years after Copernicus published his view of astronomical phenomena, a new system made its appearance in the north of Europe, invented by one of the greatest observers that astronomy ever had, Tycho Brahe;—he adopted part of that established by Copernicus; but either from prejudice or fear rejected the annual and diurnal revolution of the earth.

Having thus traced, in a distinct and highly satisfactory manner, the progress of this sublime science, Mr. WALLIS proceeded to shew that upon the simple principles of gravitation, and the effect of the projectile force, all the various appearances assumed by the planets can be at once explained, and that their direct and apparently retrograde motions, as well as their stationary appearance in some parts of their orbits, are capable of elucidation by the simplest arrangement possible.

The lecturer then withdrew for a few moments to prepare the requisite machinery, and on his return exhibited a beautiful transparency, representing the sun, the planet Venus, and the earth. The two planets were placed at their relative distances from the sun, and were made to revolve in their respective orbits according to the periods in which they are described in nature. When the planets were first put in motion, they were in conjunction, but as they moved forward in orbits of different magnitudes and with different degrees of velocity, the changes which took place in their situations with respect to each other exhibited a striking exemplification of the phenomena alluded to by the lecturer. In two parts of their orbits, the earth was seen following Venus so nearly in the same line, as to render it evident that Venus must for some time be seen from the earth in the same part of the heavens, and consequently appear stationary. In one part of their orbits, it was equally evident that the change which took place in the situation of Venus as seen in the heavens, occurred in a direction contrary to that of her real motion. During the greater part of her revolution, her real and apparent path in the heavens were in the same direction, and her motion appeared to be direct. The machinery was kept in motion till the earth and Venus were again in conjunction, as at first; and Mr. WALLIS stated that a period of 584 days elapses between each conjunction,

which is the synodic period of Venus, and as she revolves round the sun in 224 days, she completes rather more than 2½ revolutions before she is again in conjunction with the earth. The same illustration is applicable to the motions of all the other planets, both superior and inferior, and accounts for the appearance of similar phenomena. Thus the planet Jupiter, which describes about 30° of a great circle in each year, lately had an apparent motion towards the west, though in reality continuing his direct motion towards the east.

The next transparency represented the disc of the sun, with the various spots which are occasionally seen upon it. Mr. WALLIS observed, that if the planets Mercury and Venus moved in orbits level with that of the earth, they would appear to pass across the disc of the sun at every revolution, and this appearance is called a transit. He would now exhibit a representation of the transit of Venus, which, being an opaque body, would be seen traversing the surface of the sun like a black spot. This phenomenon was accordingly displayed in a very beautiful manner, and the planet slowly passed across the sun as it was seen in the year 1761. The lecturer here repeated his explanation of the method of determining the distances of the planets from the sun, by observing the transit of Venus from different parts of the earth's surface, and stated that transits of the planet Mercury occur frequently, but those of Venus very rarely. Transits of this planet took place in 1761 and 1769, which were minutely observed by astronomers, but another will not occur till 1875, as they can only happen when the planet is in or near the nodes of her orbit.

The planet nearest the sun is called mercury, and is the smallest of the planets, its diameter being about 3108 miles. As it does not recede far from the sun, it is not often seen, but it has not been ascertained by observation whether it revolves on its axis. His distance from the sun is about 37,000,000 miles.

The next planet in the system is Venus, which is 68 millions of miles from the sun, round which she completes her revolution in 224 days, and is of nearly the same magnitude as the earth. A transparency was exhibited, representing two of the phases of Venus when she appears as a crescent and a half-moon. In the former case, the rugged edge of the terminator indicated the inequalities of her surface, and in the latter, she presented the singular appearance of a small portion of the lower limb being detached from the rest of the planet, which is supposed to be owing to the strong shadow cast by a mountain. As the axis of Venus is greatly inclined to the plane of her orbit, she is subject to a great variety and quick succession of seasons, and it is presumed, from a variety of observations, that she possesses an atmosphere of considerable density. Mercury and Venus are the only planets hitherto discovered moving in orbits within that of the earth, and neither of them appears to be attended by any satellite.

The earth is the next planet in succession, but as this had been already so fully treated of, the lecturer considered it unnecessary to add any further observations.

The first of the superior planets, or those which move in orbits farther from the sun than that of the earth, is Mars. Two transparent views of this planet were exhibited, which displayed some singular spots upon his surface. Mars is the reddest of all the planets, while Venus is the brightest, and shines with a blueish light, like that of electricity. The axis of Mars is inclined about 30° to the plane of his orbit, and his diurnal revolution is nearly the same as the earth's. His atmosphere is extremely dense, for when approaching a fixed star, it is observed that before the star comes in contact with the edge of the planet, it appears distorted and discoloured, in consequence of being seen through so dense a medium. Two remarkable spots are seen at the poles of this planet, which are much brighter than the general surface, and from the accurate observations of Herschel, who found that they regularly increased and decreased in size at definite periods, it is supposed that they consist of large masses of snow or ice surrounding the poles.

The planet Jupiter revolves above Mars in the system; but Mr. WALLIS begged to defer his illustrations of this planet till his next lecture. He had experienced, in the course of the day, a severe attack of illness, which had unfortunately prevented him from arriving at the lecture-room in time to prepare the machinery which was necessary to exhibit the curious phenomena of this planet.

Between *Mars* and *Jupiter*, within a few years four new planets have been discovered, which present one of the most curious anomalies ever yet witnessed in the science of astronomy. Their orbits are so near each other, that they appear liable to collision, and an opinion has been entertained, which is confirmed by a variety of facts, that they originally formed but one planet, which by some extraordinary convulsion, has been separated into fragments.

MR. WALLIS now passed on to the planet *Saturn*, which he characterised as the most astonishing body in the universe. An ele-

gant transparency of this planet, surrounded by his immense ring, as seen in an oblique direction, and accompanied by his seven satellites, was exhibited to the audience; and the lecturer stated that this splendid ring of light is composed of solid matter, like the planet which it surrounds, but is more luminous. It is completely detached from the planet and revolves in a different period of time. The body of Saturn is surrounded by belts, similar to those of Jupiter, supposed to consist of clouds or other substances contained in its atmosphere, which arrange themselves in lines parallel to the equator in consequence of the amazingly rapid revolution of the planet on its axis. Saturn completes his revolution round the sun in rather less than 30 years, and his axis is inclined to the plane of his orbit in an angle of 30°. In different parts of his orbit he presents very different appearances to spectators on the surface of the earth. Two other transparencies were successively exhibited for the purpose of shewing the changes which take place in his appearances, in the first of which the narrow edge of the ring was turned towards the earth, and appeared to cross the body of the planet like a line. In the other the planet was shewn as it appears when the greatest part of the surface of the ring that can be seen in any part of its orbit, is turned towards the earth. When it appears in this situation, astronomers are enabled to discover that the ring is actually divided into two concentric rings, at a considerable distance from each other.

The exterior diameter of the ring of Saturn is 204,000 miles, in comparison with which its thickness dwindles to an inconsiderable line, as it is not supposed to exceed two or three thousand miles, and appears less than the diameter of its satellites. The ring is occasionally seen to throw a broad shadow on the body of the planet, which proves it to be composed of solid matter, and as the shadow of the planet is also thrown upon the ring, it is evident that they both shine by reflected light.

Another transparency exhibited the planet as it would appear if the whole surface of the ring was turned towards the earth. In this diagram, the divided ring and the body of the planet formed a series of concentric circles, exhibiting the diameter of the planet, as compared with the distance and breadth of the ring in a very distinct manner. The diameter of Saturn is 79,000 miles, and the interval between him and his first ring 35,000 miles. The breadth of the first ring is nearly 20,000; the interval between the rings, 2,900; and the breadth of the outer ring, 7,200 miles. His distance from the sun is 907,000,000 miles, and he revolves on his axis in 10 hours 16 minutes. The lecturer finally directed the attention of the audience to an apparatus on the lecture table, by means of which he explained the cause of all the varieties in the appearance of Saturn in different parts of his orbit. A lamp connected with the machinery represented the sun, and by the motion of a model of the planet and his ring, the different appearances they assume were exemplified with the greatest perspicuity. Mr. WALLIS introduced a variety of remarks on the astonishing instance of the effects of the centrifugal force exhibited by this planet; and concluded by stating that he should finish his course with the next lecture, which he trusted would include much interesting information.

FAMILIAR LESSONS ON GEOLOGY.

(Resumed from page 77.)

Silex is so universally diffused, that it would be difficult to say where it is not. Flint, chalcedony, agates, jaspers, aggregates, petrified wood, hornstone, felspar, clay, mica, &c. &c. partake largely of this substance; and the very numerous and extensive class called sandstones, coarse and fine, and of almost every denomination, is composed of it, whether reduced to pebbles, gravel, large grained sand, to sand, and to the finest particles called dust, in which state it enters succulent vegetables, as the stems of rice, &c. to which it adheres in the early stage of their growth, and is perhaps conducive to the perfecting of the plant.

*Felspar** is considered the second constituent of granite,† and in some varieties it is more abundant than quartz, though not quite so hard.

When a piece of granite is broken, the felspar in it generally appears as if split or divided, having a smooth flat fracture, and a regular form, or a tendency towards it, which is not the case with quartz.

Felspar is commonly of a grey colour, and has a shining silk-like lustre; it is often pale red, and then forms red granite.

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* This substance, properly speaking, belongs to the argillaceous class, but as it associates with quartz to form granite, we have thought it best to introduce it here.

† Quartz, felspar, and mica, are understood to form granite; but it often contains a large portion of hornbrende, which in some cases resembles mica. *Tourmaline*, and *schorl* is commonly imbedded in this rock, also precious stones are found in it, &c. &c.

It rarely occurs transparent, or blue, or green; what is called labrador, or irredescent felspar is very beautiful; it exhibits the finest colours, as blue, green, red, yellow, in the same specimen.

Felspar is in distinct or aggregated crystals, or disintegrated; it also occurs massive. It is often in decomposition, when it becomes dull, earthy, and passes into clay. If these characters are well noticed, felspar will easily be distinguished, particularly in granite.

Mica, the remaining constituent of granite, is of a yellowish colour, and has a strong metallic lustre; often appears as if composed of leaves, divides, separating as thin as fine paper, and is extremely elastic. In mass it has frequently a smoky brownish tinge, but in laminæ, is generally so transparent as to be used to cover objects for the microscope; and in Russia is used for windows, hence called Muscovy glass. It is often seen in soils as at the bottom of rivulets in South America, and many have brought this substance from abroad believing it to be gold! Mica is soft, easily scratched by the knife, and produces a white flaky powder.

Mica belongs to the magnesian class, but as it forms a constituent of granite, we have thought it best to explain its characters to the beginner, after those of quartz and felspar, as they are commonly associated together.

The next in abundance of earthy substances in nature is *limestone*.

Primitive limestone occurs in granitic formation, and is supposed to be of the same origin. This limestone is granular as *dolomite* and some varieties of statuary marble; or compact, as that from the Isle of Firee. It does not contain any animal remains or vegetable impressions; as a primitive rock, it is not very abundant, neither is it considered so in the transition formation, where it sometimes contains traces of organic remains (petrifaction).

In the secondary, or what is termed the flat formation, limestone is very generally distributed, forming mountains of less magnitude, valleys, and plains; it has a regular stratified appearance, shewing signs of deposit at different and distant periods. This limestone appears in great part to be formed of marine petrifactions.

These mountains, though of small extent, present perpendicular and very rugged features; as if separated from each other by some violent concussion, dislocating their strata, which, in many situations, is thrown in great confusion. In it fissures of great depth and magnitude appear, some of which are filled with metallic substances, as lead ore, and are generally accompanied with calcareous spar.*

Those limestones called marble, extend to innumerable varieties: the black is much esteemed, the best in this country is in Derbyshire, near Ashford, belonging to the Duke of Devonshire, where mills are erected for working, also at Derby.

Chalk belongs to this order, and pervades a considerable extent of country, as may be seen in Phillips' excellent work. It is too well known to need any description.

Gypsum, *alabaster*, is lime combined with sulphuric acid. It is very abundant in Derbyshire and Nottinghamshire, and forms a considerable extent of country, filling cavities in the red marl and rising into low hills.† It is soft, and may be scratched by the nail, which sufficiently distinguish it from marble.

The argillaceous order is considered next in abundance; it commonly appears in the form of clay, and is more or less indurated.

(*To be resumed.*)

COMBINATION LAWS.

The labours of the Commons' Committee on this important subject have terminated, and the result is a Bill containing, among others, the under-mentioned provisions. The first clause of the Act provides for the repeal of the *existing law*, 5 Geo. 4th, c. 95.; but at the same time, in express terms, declares that the Acts repealed by that Act, and the two immediately preceding chapters *are not to be considered revived*, but to "remain repealed, except so far as they repeal any former enactment." The second clause imposes the punishment of inprisonment, with hard labour for months for the following offences;—

* Calcareous spar is usually of a yellowish colour, more or less diaphanous; it is doubly refractive, and when transparent, shews that power in proportion to its thickness. If a pin be put underneath it, *two* will appear, distant from each other in that proportion as the specimen is thicker or thinner; when broken, its fragments have regular rombic form.

† Lime combined with fluoric acid, forms the beautiful fossil called fluor; that variety from which such elegant and beautiful vases are made in Derby, is peculiar to one mine. Fluor has generally a cubic form. Fluoric acid attacks and corredes glass, which no other acid acts upon.

1st. For forcing, or endeavouring to force, any person to depart from his hiring, employment or work, by violence to his person or property, or by threats or intimidation.

2d. For forcing, or endeavouring to force, any person to return his work before the same is finished by the same means.

3d. For preventing or endeavouring to prevent, by the same means, any person not hired or employed, from hiring himself to, or accepting employment from, any other person.

4th. For using any such violence, threats, or intimidation, for the purpose of forcing or inducing such person to belong to any club or association; to contribute to any common fund; to pay any fine for not belonging or not having contributed to any particular club; or for having refused so to contribute, or to pay such fine, to comply with any rules or orders made to obtain an advance of wages, or to lessen the hours of work, or to decrease the quantity of work, or to regulate the mode of carrying on any manufacture or trade, or the management thereof.

5th. For forcing, or endeavouring to force, by such violence, threats, or intimidation, any manufacture or any person carrying on any trade or business; to make any alteration in his mode of regulating, managing, conducting, or carrying on such manufacture; or to limit the number of his apprentices, or the number or description of his journeymen or workmen.

Masters are by clause 3 permitted to meet and enter into agreements for settling the rates of wages that shall be paid to their workmen by persons present at such meetings, or being parties to such agreements, and the workmen are allowed by clause 4 the same privileges, with the addition of settling the hours of work. Offenders can be compelled to givel evidence' against each other; the witness in such case being indemnified for any confessions he may make inculpatory of himself. Then follows the clause giving summary jurisdiction to magistrates for the foregoing offences.

We have extracted the preceding clauses from the Act now in progress, because they seem to prove that its enactments are principally intended to prevent a recurrence of instances of violence and intimidation, while they leave to the operative classes the right of combining for the *peaceful* protection of their own interests.

To the Editor of the Mechanics' Register.

Sir—Will you have the kindness to explain to me the full meaning of the words "*directly*" and "*reciprocally*," so frequently used by Emerson in his "Mechanics," as I have searched into Dictionaries and Encyclopædias unsuccessfully.

Any one of his early problems will show you in what way the words are used, but I have copied one for fear you may not have his work at hand:—

Prop. 3. In all uniform motions, the space described is in the *compl cate* ratio of the time and velocity. For it is evident, if the velocity be given, the space described by any body, will be as the time of its moving. And if the time be given, the space described will be greater or less, according as the velocity is greater or less; that is, the space will be as the velocity. Therefore, if neither be given, the space will be in the compound ratio of both the time and velocity.

Corollary. The time is as the space *directly*, and velocity *reciprocally*.

Is it to be understood by the word *complicate*, that the time and velocity are to be *multiplied* together.

Perhaps you will insert the answer in your valuable Register, as it will, no doubt, be useful to many beside myself. What a pity clever writers should so mystify science! A person must understand the science of mechanics before he can understand what Emerson has written in order to teach him. He reminds me of the practice in many schools of giving the scholars a grammar in Latin to enable them to learn that language.—I am, Sir,

Your constant reader,

Lambeth. Tyro Mechanicus.

*** Our correspondent is mistaken in supposing that the terms used by Emerson, are such as ought to be explained in an elementary work on Mechanics. The doctrine of ratios belongs entirely to those sciences which treat of quantity abstractedly; that is to say, to geometry, arithmetic, and algebra. We shall however, endeavour to give as clear an account of the nature of ratios as possible, without going too deeply into the subject.

When the number of units contained in a quantity, is equal to the number contained in another quantity, *multiplied* by a constant number, the quantities are said to be in direct proportion to each other; or the one is in the direct ratio of the other. Thus if a man walk at a constant rate of four miles per hour, at the end of two hours

he will have walked eight miles, at the end of three hours, 12 miles, &c. &c. Here the number of units in the distance, is always equal to the number of units in the time multiplied by a constant quantity, which is here four. The time is therefore said to be *directly* as the velocity.

A quantity which contains a number of units, equal to a constant number *divided* by the number of units in another quantity, is said to be inversely or reciprocally as that quantity.

It is evident from this definition, that in passing over a given distance with different velocities, the velocity will be *inversely* as the time. If one man walks ten miles in three hours, and another walks ten miles in four hours, and a third ten miles in five hours, they will walk with the velocities of 3⅓ miles an hour, 2½ miles an hour, and 2 miles an hour, respectively. But it is found that 10 divided by 3=3⅓; 10 divided by 4=2½;—and 10 divided by 5=2; consequently the velocities are *indirectly* as the times. Here the constant number is 10.

Lastly, when a quantity always contains a number of units, equal to the product of the number of units in two other quantities, and a constant number, the first quantity is said to vary in a ratio compounded of the other two.

By proceeding as in the other examples, we shall find that the distance is in the *compound* ratio of the velocity and the time.

WOOD TRANSFORMED INTO MARBLE.

An account of a discovery in the arts, entitled as above, has been transmitted to us by M. Malo, the Inventor, a French gentleman residing at No. 20, Newman-street, Oxford-street, who is desirous of disposing of the secret; and if the invention is capable of producing the effects attributed to it, we should imagine that in this age of speculation he will not be under the necessity of waiting long for a purchaser.

"This secret," says M. Malo, "consists in imitating (by means of a paste laid in, or rather wrought in wood, without incrustation,) the most precious and rare kinds of natural marble; and creating, according to the dictates of fancy or imagination, such different sorts of marble, as nature does not produce.

"Up to this period, marble could only be produced by nature; but in future, by the use of this invention, the richest and rarest marble can be procured, with those thousand accidental fusions, veins, shades, and transparencies, &c., which the ablest painter can but imitate on the surface, with great expense, and after all, insufficient in its execution, as well as in result. The patent marble can be made of any size or thickness, and with a perfection which the art of painting may imitate, but can never equal.

"The substance of this composition is of the greatest solidity, and does not want any retouching, or amelioration, for many years; it can be washed, and cleaned, with an ordinary sponge. In case of accident, or many years wear, it may be planed and renewed, in the same way as common wood; the shavings thus taken off will shew every vein of the marble thus imitated, leaving the under part, with all the veins, shades and polish entire, and without, in any way, injuring the finish, or beauty of the workmanship.

"Wherever the most magnificent marble can be used, this can be produced, with veins of gold, silver, mother of pearl, &c.; indeed, it can be enriched with all the wonders of the mineral world.

"In England, where many of the staircases, doors, floors, chimney decorations, &c. are generally of common wood, the adoption of this invention as a cheap and magnificent substitute, must certainly prove a most profitable employment of capital, as, with little more expense, the present uniformity of the houses and hotels can be changed, and present to the eye, as by enchantment, a sumptuous and infinite variety of marbles, combining all the durability of wood."

ANTI-INCENDIARY COMPOSITION.

The same gentleman has also informed us that he has invented a composition, which is applicable to the prevention of the dreadful effects so frequently arising from fires. He observes, that as this composition can be applied upon any object whatever, ships, houses, and manufactures of every description may be henceforth secured from combustion; and that not only wood and cloth, but paper and straw being impregnated with it, will be rendered *flame proof*. This composition has been submitted to the examination of the *Institut Royal de France*, and unanimously ap-

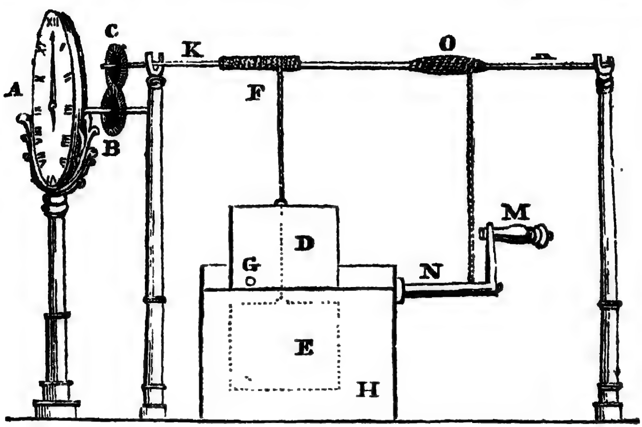
proved of by the most celebrated chemists and learned men in that kingdom.

WATER CLOCK FOR GARDENS, &c.

To the Editor of the Mechanics' Register.

Sir—Perceiving that you have admitted several contributions on different improvements and inventions, I take the liberty of sending you the plan and description of a machine, which, I think, will be found rather a useful thing for the country, and which occurred to me the other day when looking at an hour-glass. It is a Water Clock, on a very simple plan, which may be placed in gardens, &c. and will, I think, answer the purpose very well.—Your insertion of it will oblige yours, &c.

JUVENIS ADMIRATOR.



REFERENCES TO PLATE.

A is a dial plate three feet in diameter, with the hours, &c. accurately marked, and a hand fastened as usual to a spoke, in the middle of which, at back of the dial plate, is a tooth wheel B, turned by another C, attached to the rod K K, on which is rolled the cord F.—H is a well of water about four feet diameter, on which is set the vessel D attached to the cord F. In the bottom of this vessel there is a small hole at G, and when it is set on the water it gradually sinks, on account of the water coming through the hole; and dragging the cord F, turns the rod K K, which communicates motion to the wheels, and makes the index of the clock revolve. When the vessel is quite sunk as at E beneath the surface of the water, it is to be wound up again by the handle M*, and the resinking of the vessel unrolls the cord from N to O, and it is thus ready for winding-up again. The size of vessel and hole should be regulated so as to make the clock go during the time required. The time of its going may also be varied by having the wheel C larger or smaller. Thus if when the wheels are of the same size, it goes 24 hours, by making the wheel C seven times as large as B, it will go a week at once, as one turn of C will make seven of the wheel B, &c.

* There should be a valve at the bottom of this vessel to open downwards to facilitate its elevation as described above.

MOTION OF A CANNON BALL TOWARDS THE CENTRE OF THE EARTH.

We have received one or two answers to the letter inserted in our last Number, page 126; but as the meaning of our correspondent T. S. was rendered rather obscure by some incorrectness in transferring his manuscript to our pages, we have deferred the insertion of the replies, to enable the writers to comprehend distinctly the inferences drawn by T. S. whose illustration of the diagram should have been as follows:—

"Let the circle A B represent the earth, C the centre; the spaces between the concentric circles to be each one-eighth of the diameter, or 1000 miles. When the ball arrives at the point D, I conceive the force

of attraction would act upon it in the manner represented by the right lines from the point D to the circumference of the circle. The ball would, in this situation, be attracted by a force equal to three towards the point from which it first began to descend, and by a force equal to five towards the centre; the ball would consequently, in my opinion, become lighter and its accelerated force be counteracted and decreased, in proportion as it proceeded towards the centre. When arrived within a mile of the centre, it would be attracted by forces in opposite directions so nearly equal, viz. 3999 and 4001, that it would possess scarcely any motion or weight, and when arrived at the centre would lose both, and remain there stationary."

QUERIES.

No. 43.

Sir—If any of your correspondents will inform me which is the best preparation for brass and copper wire during the process of drawing; and also which is the best wood coal for annealing it, they will much oblige A Constant Reader.

No. 44.

Sir—I shall feel obliged to any of your correspondents if they can inform me of the best method of gilding the edges of books.
M. M. T.

Sir—I should be happy to obtain information on the following queries through the medium of your Register.
Yours, W. H.

No. 45.

The most efficacious method of stuffing and curing of beasts, birds, fishes, insects, and reptiles.

No. 46.

A remedy for taking out verdigris from tea urns, without injury to the metal.

No. 47.

How to make amber varnish.

No. 48.

The method of making wood varnish.

No. 49.

The method of preparing transparent soap.

No. 50.

Sir—Observing in your Register, Vol. 1. page 159, a colour called *mountain blue*, and as I know of no such colour in existence, I shall feel greatly obliged to any of your correspondents if they can inform me where such a colour is to be purchased.
Yours, &c. A. Z.

No. 51.

MAGNETISM.

Sir—Can any of your numerous correspondents inform me if it is possible to communicate to a bar of steel *similar poles* at each end; so that when it is suspended, *both ends* shall possess *north*, or *both south polarity*, at the pleasure of the person making such an instrument?
Yours, &c. B.

ANSWERS TO QUERIES.

QUERY, No. 35, Page 96.

TO DESTROY INSECTS.

Insects which infest many garden plants and ruin their sap, may be thus effectually destroyed:—First water the plant well, and let it remain till nearly dry to bring the vermin from their holes, then take a handful of strong tobacco, (shag for instance) and place it round the lowest part of the stalk, but without letting it touch; then light it all round, so that the smoke in burning should surround the plant, which will stifle any living creature it may contain. At first the leaves will be rather discoloured, but the air will soon restore them.
Opifici Amicus.

QUERY, No. 36, Page 96.

RESPIRATION OF INSECTS.

All insects are provided with pores in their skin, called "Spiracles," by means of which they respire. Opifici Amicus.

QUERY, No. 38, Page 96.

AGRICULTURE.

First—There are seven sorts of soils, viz. clayey, loamy, chalky, sandy, gravelly, peaty, and moory. The stiff soils consist of clayey and loamy; and the light, of sandy and gravelly.

Secondly—Grains which may be cultivated on stiff soils, are wheat, oats, and beans; pease, oats, and barley, on light.

Thirdly—The manuring of rotation is this:—By too often growing the same crop, the soil becomes impoverished, therefore farmers have a succession of different crops which is called rotation. Grain and white crops exhaust the soil; tares, turnips, and all green crops restore it.

Fourthly—The causes of barren soils are, that they consist of too much of the same material—are void of moisture—or that they are too shallow.

Fifthly—A barren soil may be rendered fertile by frequently turning it up to the air and mixing it with manures, which manures consist of dung, decayed vegetables, lime, and marl. Opifici Amicus.

QUERY, No. 28, page 62.

CAPILLARY TUBES.

To the Editor of the Mechanics' Register.

Sir—Your 32nd number contains the following queries from Mr. Thos. Taylor, on the subject of capillary tubes:—

"1. If a capillary tube, or a hair-like tube of glass, be dipped at one end into water, the water will rise within the tube to a height which will be reciprocally proportional to its diameter, and both in its ascent and after it has arrived to its utmost height, its surface will be concave. What is the cause of its concavity?"

"2. If a small column of mercury be similarly suspended, or even as supported in the barometer, the surface of the column will be convex. What is the cause of its convexity."

Your correspondent is doubtless aware, that water rises within a capillary tube by reason of the attraction exerted on it by the inner surface of the tube. Now it is but reasonable to conclude that the attraction which the glass exerts on the water will be strongest toward those particles which are nearest it. This will occasion the edge of the column to rise higher than the middle, and its surface will consequently assume a concave form.

With respect to the second inquiry, I would beg leave to remind your correspondent, that mercury in the barometer is suspended on a very different principle from that on which water is supported in a capillary tube. It is not drawn up by the attraction within the tube; but is impelled by the pressure of the atmosphere without. In its progress up the tube, the particles next the glass will, of course, have to encounter the *friction* generated by their passage. Now, as the attraction or cohesion in fluids is much more imperfect than in solids, their particles move freely among each other. On this account, only that portion of the liquid which touches the glass will be acted upon by the friction. The outside, therefore, of the mercurial column will be retarded in its ascent, by friction against the inside of the tube, while the middle of the column, not having to contend with the friction of the glass, will rise to a greater height than the other portion of the metal. In this manner the convexity of its surface will be occasioned.

Independently of this, your correspondent is no doubt aware, that all fluids have a tendency to assume a globular form, when not acted upon by any countervailing force. A better example of this could not, perhaps, be afforded, than by the metal before us. If a portion of quicksilver be suffered to fall on a flat surface, I need scarcely say it will arrange itself in globules very nearly approaching to a perfect sphere.

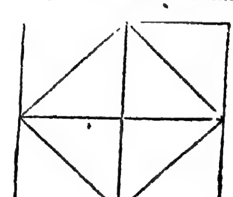
If, likewise, we fill a vessel with water to the brim, we shall find that its surface will rise above the edge of the vessel; or, in fact, as in the instance before us, its surface will not be flat, but convex; because, following the general law of fluids, it has a tendency to assume a globular form. This, then, might possibly afford a sufficient reason for the convexity of the mercury, without reference to the friction which it encounters in its ascent.

I trust, Mr. Editor, I have succeeded in showing that there is by no means so much similarity between the causes of the facts mentioned by your correspondent, as he may have been led to imagine. And consequently, that it is not a matter of surprise if there should exist that diversity in their effects, for which your correspondent is at a loss to account. Should you think this explanation likely to prove satisfactory, it is heartily at your service.

I am, Sir,
Your obedient servant, N. R.

Volume 1, page 143.

The square must be divided into eight parts, as in the following figure, and it will be found that by joining them together four and four, two equal squares will be produced exactly half the size of the original.



One of the small squares is already formed in the figure, and the four exterior parts will form the other. The side of the squares will be half the diagonal of the larger one. Fox.

QUERY, No. 20, page 31.

TO REMOVE SPOTS OF WAX, &c.

I should certainly recommend ether or spirits of turpentine, which will not affect the colour or nap of the cloth; but in stating "cold water," as does J. Webb in your 32nd Number, page 64, he is most certainly mistaken, particularly as the wax, and those sort of things, generally penetrate more or less the body of the cloth.

F. C.

Volume 1, page 190.

CONTENTS OF A PIT, &c.

Two hundred and sixteen solid feet were dug out of it. By the bye, it may not be unacceptable to some of your readers if I give the rule for making this and similar calculations:—A square being the solid body we wish to measure—Rule, square the diameter, and multiply by the depth; thus taking your correspondent's case:—

$$\begin{array}{r} 6 \\ 6 \\ \hline 36 \\ 6 \\ \hline 216 \end{array}$$ cubic feet is the answer.

Here I have multiplied the breadth by the breadth, *thus squaring the diameter:* I then multiplied by the depth, and got 216 cubic or solid feet for answer. And these may, by another rule, be reduced into gallons, &c. as may be wished. I have added a view of one side of the above named square, which shews the feet superficial measure; and a moment's consideration will explain how 216 feet are brought out, since every side is thus divided.

To measure a parallelopipedon; rule, multiply the length by the breadth, and the product by the depth, thus a body shall be twelve feet long, six broad, and two deep, then

$$\begin{array}{rl} 12 & \text{feet length} \\ 6 & \text{breadth} \\ \hline 72 & \\ 2 & \text{depth} \\ \hline \end{array}$$

Gives answer 144 cubic feet.

F. C.

Volume 1, page 193.

LUMINOUS APPEARANCE OF A POKER, &c.

I should conceive the poker is immediately surrounded by the sticky fat or oil of the soap, and a portion of alkali; and as the heat does not begin to pass rapidly off until ebullition has commenced, and as fat and oil require a very high temperature to boil them, they will continue absorbing heat, and giving out but little to the water for a considerable space of time, thereby keeping the poker luminous longer than water would.

F. C.

Query, No. 20, Page 31.

Sir,—Your correspondent Mechanicus will find no difficulty in removing the drops of wax complained of, with some warm spirits of turpentine applied with a linen rag; occasionally rubbing the place on which they lay between the fingers, and then dipping the cloth into warm spirits of wine to take off the smell of the turpentine.

I am, Sir, yours, &c.

JAMES MARSH.

Woolwich, May 28.

TO CORRESPONDENTS.

Having briefly stated, on the wrapper of our last Number, that a change had taken place in the proprietary of the London Mechanics' Register, we beg to repeat that the work will in future be published by Mr GIFFORD, at his Weekly Publication Office, Paternoster Row where our Correspondents are respectfully requested to transmit their communications, addressed to the EDITOR, post paid. At the same time, we request permission to assure our numerous Subscribers and the Public in general, that neither exertion nor expense will be spared by Mr Gifford, the present Proprietor, to preserve and extend the reputation already acquired by the London Mechanics' Register, as the cheapest and most useful periodical ever offered to the Public.

We feel some hesitation on the subject of the ingenious letter of N. R. We accompanied him in his satirical flight till we began to be of opinion that his excursive imagination had carried him too far. Perhaps, upon consideration, his sentiments may coincide with our own, and he may be disposed to animadvert with more seriousness, and less severity, on the "discovery" to which he alludes. We shall be happy to receive the communication mentioned at the close of his letter

Mr Green's communication will appear next week.

An Old Sailor: S. P.'s reply to the Optical Question: Mr Dewhurst's Steam Washing Apparatus; D. Thomas's answer to Mr. Pope; and the favours of several other Correspondents will also be inserted in our next Number if possible.

We are obliged to Y. M for his suggestions, and shall leave a letter for him at the Publisher's on Tuesday next.

ERRATA.—We have to apologise for the following errors in our last Number, which arose from circumstances connected with the recent change in the proprietary of the Work:

Page 124, col. 1, line 5, for "revelation" read "revolution."

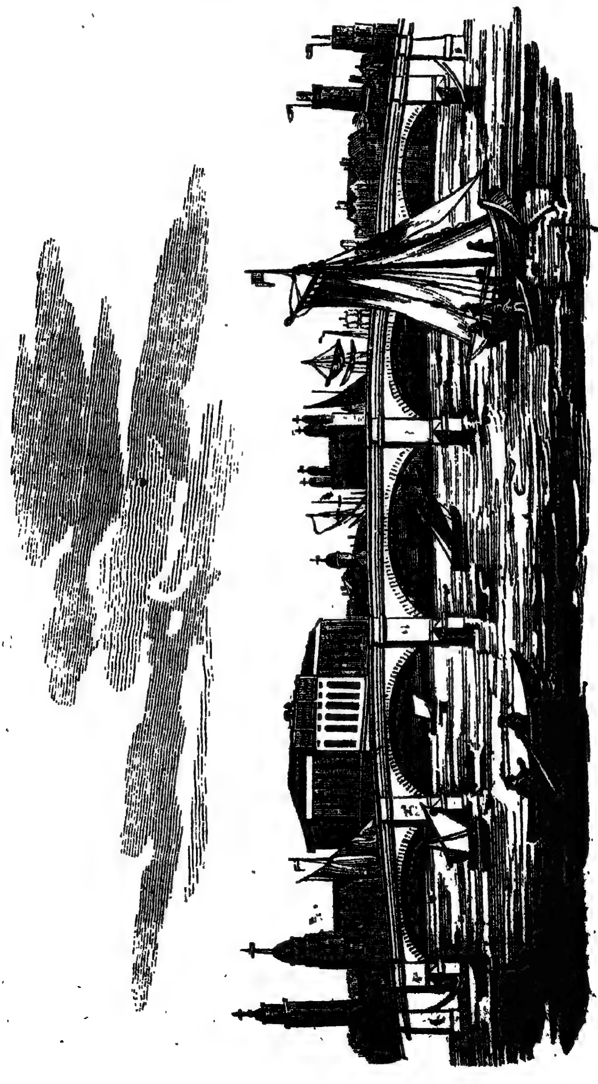
Page 124, col. 2, line 13, for "elastic gun tube," read "elastic gum tube."

Page 127, col. 2, line 25, for "purified," read "rarefied;" and line 33, for "infringes" read "impinges."

THE LONDON
MECHANICS' REGISTER.

" Then Commerce brought into the public walk
" The busy merchant; the big warehouse built;
" Raised the strong crane; choked up the loaded street
" With foreign plenty; and thy stream, O THAMES,
" Large, gentle, deep, majestic, King of Floods,
" Chose for his grand resort!"—THOMSON.

No. 38.] SATURDAY, JULY 2, 1825. [Price 3*d*.



VIEW OF THE NEW LONDON BRIDGE.

CEREMONY OF LAYING THE FOUNDATION STONE OF THE NEW LONDON BRIDGE.

The engraving which embellishes our present Number, is a correct and spirited representation of the New London Bridge, as it will appear when completed, and we flatter ourselves will be highly acceptable to our readers. The ceremony of laying the first stone of this great national work took place on Wednesday the 15th ult. and was conducted with all the impressive formalities which the importance of the occasion demanded.

It was justly observed by a contemporary, that a ceremony like the present is one of those public occurrences which may be considered as an event in a man's life, and an epoch in the city's history—a sort of station in one's worldly journey, from which we measure our distances and dates. To witness the manner and the moment, in which is laid the first single resting stone of a grand national structure—the very origin of the existence of a massive and magnificent pile, which will require years to complete, and ages to destroy, has an elevating and sublime effect on the mind.

Great public works are the truest signs of a nation's prosperity and power; originally its grandest ornaments, and ultimately the strongest proofs of its existence. Its religion, language, arts, sciences, government, and history, may be swept into nothingness; but yet its national buildings will remain entire through the lapse of successive ages—after their very founders are forgotten—after their local history has become a mere matter of conjecture. The columns of Palmyra stand over the ashes of their framers, in a desert as well of history as of sand. The palaces of imperial Rome are still existing, though her religion, her very language, is dead; and the history of the man-wrought miracles of Egypt, had been looked at but as the very dreamings of philosophy long before Napoleon said to his Egyptian army, "From the summits of these pyramids, forty centuries are looking down upon you."

Of all public edifices, a bridge is the most necessary, the most generally and fre- [illegible] to all persons. It was probably the very first public building. Some conjecture, that the first hint of it was taken from an uprooted tree lying across a narrow current. What a difference between that first natural bridge, and the perfection of pontifical architecture—the vast, solid, and splendid Waterloo—the *monumentum et quæras* of John Rennie. We feel pleasure in learning, that the new London-bridge has been designed by the same distinguished architect. It falls to the lot of the son to consummate the plans of the father—we hope with equal success, and with similar benefits, as well to the conductor as to the public.

The following is a statement of the dimensions of the new bridge:—

Centre arch—span, 150 feet; rise, 32 feet; piers, 24 feet.

Arches next the centre arch—span, 140 feet; rise, 30 feet; piers 22, feet.

Abutment arches—span, 130 feet; rise, 25 feet; abutment, 74 feet.

Total width, from water-side to water-side, 690 feet.

Length of the bridge, including the abutments, 930 feet; without the abutments, 782 feet.

Width of the bridge, from outside to outside of the parapets, 55 feet; carriage-way, 33 feet 4 inches.

The design for the new bridge has been truly characterised as extremely striking for its contrast with the present gothic edifice, whose place it is so soon to supply. It consists but of five elliptical arches, which embrace the whole span of the river, with the exception of a double pier on either side, and between each arch a single pier of corresponding design: the whole is more remarkable for its simplicity than its magnificence; so much, indeed, does the former quality appear to have been consulted, that it has not a single balustrade from beginning to end.

Every arrangement having been previously made to give due effect to the ceremony, the Lord Mayor, accompanied by His Royal Highness the Duke of York, the sheriffs, the aldermen, and other distinguished officers of the corporation, proceeded from Guildhall in all the grandeur of civic magnificence; the procession being joined by many members of Parliament in their carriages, and headed by a detachment of the Royal Artillery Company. Another body of the same regiment brought up the rear, and the numerous flags and banners which floated in the air, together with the

martial tunes played by different bands of music in succession, imparted additional animation to the spectacle.

On the arrival of the procession at London Bridge, the company passed through an opening in the balustrade to an extensive platform, from which they descended by a stair-case to the coffer dam formed in the bed of the river, on the Southwark side, for the building of the first pier.

The entire coffer-dam was ornamented with as much taste and beauty as the purposes for which it was intended would possibly admit, and was divided into four tiers of galleries, along which several rows of benches, covered with scarlet cloth, were arranged for the benefit of the spectators. It was covered with canvas to keep out the rays of the sun, and from the transverse beams erected to support it, which were decked with rosettes of different colours, were suspended flags and ensigns of various descriptions, brought from Woolwich yard; which by the constant motion in which they were kept, created a very refreshing current of air. The floor of the dam, which is 45 feet below the high water mark, was covered, like the galleries, with scarlet cloth, except in that part of it where the first stone was to be laid. The floor is 95 feet in length, and 36 in breadth; it is formed of beech planks, four inches in thickness, and rests upon a mass of piles, which are shod at the top with iron, and are crossed by immense beams of solid timber.

The Lord Mayor dressed in his full robes, and supported by the Duke of York and Mr. Alderman Wood, took his seat opposite the place where the first stone was suspended by a tackle, ready to be swung into a place which it is destined to occupy for centuries. The Latin inscription upon the stone, of which the following is a translation, was composed by Dr. Coplestone, Master of Oriel College, Oxford:—

TRANSLATION.

The free course of the river
being obstructed by the numerous piers
of the ancient bridge,
and the passage of boats and vessels
through its narrow channels
being often attended with danger and loss of life
by reason of the force and rapidity of the current,
the City of London,
desirous of providing a remedy for this evil,
and at the same time consulting
the convenience of commerce
in this vast emporium of all nations,
under the sanction and with the liberal aid of
parliament,
resolved to erect a bridge
upon a foundation altogether new,
with arches of wider span,
and of a character corresponding
to the dignity and importance
of this royal city:
nor does any other time seem to be more suitable
for such an undertaking
than when in a period of universal peace
the British empire,
flourishing in glory, wealth, population, and
domestic union,
is governed by a prince,
the patron and encourager of the arts,
under whose auspices
the metropolis has been daily advancing in
elegance and splendour.

The first stone of this work
was laid
by JOHN GARRATT, Esquire,
lord mayor,
on the 15th day of June,
In the sixth year of king George the Fourth,
and in the year of our Lord
M.D.CCC.XXV.

John Rennie, F. R. S. architect.

The ceremony commenced by the children belonging to the ward schools, Candlewick, Bridge, and Dowgate, singing "God save the King." They were stationed in the highest eastern gallery for that purpose; the effect produced by their voices, stealing through the windings caused by the intervening timbers to the depth below, was very striking and peculiar.

His lordship then deposited in a bottle the various coins of the present reign, and having received from different gentlemen the English inscription incrusted in glass, the mallet, the level, and an elegant silver-gilt trowel, and inspected the plans and drawings of the bridge, which were laid before him by the engineer, John Rennie, Esq. his lordship addressed the numerous and splendid assemblage of ladies and gentlemen who crowded the coffer-dam, in a concise but extremely appropriate speech, after which he spread the mortar, and the stone was gradually lowered by two men at the windlass.

When the stone was finally adjusted, the lord mayor struck it on the surface several times with a long-handled mallet, and proceeded to ascertain the accuracy of its position, by placing a level on the top of the east end, and then to the north, west, and south; his lordship passing to each side of the stone for that purpose, and in that order. The city sword and mace were then placed on it crossways, the foundation of the new London-bridge was declared to be laid; the music struck up "God save the King;"* and three times three excessive cheers broke from the company; the guns of the honourable Artillery Company, on the Old Swan Wharf, fired a salute by signal, and every face wore smiles of gratulation. Three cheers were afterwards given for the Duke of York; three for Old England; and three for the architect, Mr. Rennie.

It was observed in the coffer-dam, as a remarkable circumstance, that as the day advanced, a splendid sun-beam, which had penetrated through an accidental space in the awning above, gradually approached towards the stone as the hour for laying it advanced, and during the ceremony shone upon it with dazzling lustre.

At the conclusion of the proceedings, the lord mayor, with the duke of York, and the other visitors admitted to the floor of the coffer-dam, retired; after which, many of the company in the galleries came down to view the stone, and several of the younger ones were allowed to ascend and walk over it. Some ladies were handed up, and all who were so indulged, departed with the satisfaction of being enabled to relate an achievement honourable to their feelings.

LONDON MECHANICS' INSTITUTION,

MR. DANGERFIELD'S LECTURE ON STENOGRAPHY.

WEDNESDAY, JUNE 22.

Mr. Dangerfield, the author of a treatise on Stenography, or Short Hand, published a few years ago, delivered this evening a lecture on the principles of that useful acquirement, which he commenced by observing, that while the efforts of the human mind were so universally directed to the improvement of the various branches of knowledge, it was rather extraordinary that the art of short hand should be so little known, and considered so difficult of attainment. Its utility was generally admitted, but it was thought to be of a puzzling nature, and more difficult to decypher than to learn. He hoped, however, that he should be able to prove its attainment easy, and to divest it of the difficulties which were supposed to be attached to it.

Mr. Dangerfield then divided the subject of his lecture into three parts, comprehending—1. An account of the origin and progress of the art;—2. An explanation of the principles upon which it is founded; and—3. Observations on its utility.

With respect to the origin of short hand, we are led to consider in what manner mankind originally acquired the art of writing at all, and upon this subject different opinions have prevailed. Some have imagined that writing originated in the anxiety of individuals to convey information of events to friends at a distance from them, and particularly to make known their privations, and solicit assistance when suffering from plunder and imprisonment in a distant country. Wants of this kind would suggest their delineation by means of pictures, which would lead to hieroglyphics. These would be succeeded by significant characters, which would finally assume an alphabetical arrangement. It is doubtful in what manner the alphabet was divided into vowels and consonants, but it is probable that the first letters expressed entire syllables. Others have conceived that as the power of speech was originally bestowed upon man, the power of writing was communicated with it. Many persons believe that the Hebrew letters and vowel points were given by the Almighty to Moses with the Ten Commandments. From the great antiquity of the art of writing, and the variety of opinions entertained respecting its origin, it cannot, however, be expected that we should be able to trace it to its source. In the early ages of this invention, many obstacles to the conveyance of letters must have existed, for the writings of the patriarchs were inscribed on hard substances, which were not easily removed, and to apply the art to the purposes of correspondence, the facilities of convenient roads, messengers, writing materials, &c. were essentially necessary. The earliest writings appear to have been engraved on stone, and placed in some conspicuous situation for the purpose of communicating information to those who had opportunities of inspecting them. In the 19th chapter of the book of Job, verses 23, 24, the following passage occurs, which proves the great antiquity of writing, and confirms the fact that ancient writings were engraved on hard substances;—"Oh that my words were now written! Oh that they were printed in a book! That they were graven with an iron pen and lead in the rock for ever!" &c. Mr. Dangerfield then read what he considered a more literal and correct translation of the same passage, and proceeded to state that the Romans were the first who adopted a method of *abbreviated writing*, and that there was reason to believe there were many persons among them, who possessed a knowledge of stenographic characters. The lecturer then read the title of a treatise on short hand published about a century ago by Mr. Weston, exhibiting a curious specimen of the quaint and verbose style of the title page of that period, and concluded his sketch by a brief allusion to the subsequent improvements in the art of stenography introduced by Rich, Mason, Gurney, Taylor, Lewis, and other writers.

Mr. Dangerfield then entered upon an explanation of the principles upon which short hand is founded, and observed that as

its object is to enable the writer to follow a speaker correctly, considerable practice is necessary to its attainment. The characters should be read over immediately after they are written, for in some cases, if short hand notes are not examined without delay, the writer finds it difficult to read them at all. The characters as well as the rules should be as simple and as few as possible, and there should be no exceptions* to the latter. Stenographic characters should be geometrical, and should consist of circles, curves, lines, and points. Vowels should be discarded, except when the omission of the initial or final vowel was likely to occasion a difficulty in reading the word. The lecturer then explained the nature of *vowel strokes*, which he strongly recommended as extremely useful in enabling the writer to read his notes with the greatest facility. As Mr. Dangerfield's system includes the omission of nearly all the vowels, the plan which he suggested of carefully examining the short hand notes as soon as they are written, and marking with *red ink* the places of the vowels, appeared well adapted to facilitate the reading of the characters at any distance of time. The different vowels were almost all expressed by a short stroke of the pen, placed horizontally, perpendicularly, or diagonally, according to the vowel which it represented, and by the addition of these vowel strokes, a child of 12 years old could read short hand notes without difficulty.

The various characters used in Mr. Dangerfield's system being chalked upon a large drawing board, the lecturer referred to them as he proceeded to illustrate the subject, and pointed out in succession the different letters they expressed, and gave several examples of the manner of joining them so as to form words. As however our readers could derive but little practical information from so brief a description of the characters as our limits would allow us to give, we shall merely observe in general terms, that Mr. Dangerfield's system appears to possess considerable advantages from the simplicity of its rules and the fewness of its characters, which are only about twelve in number. The same character expresses different letters, which are similar in sound, or nearly alike in power: thus a short horizontal line represents *c* soft, *s*, *x*, and *z*; a perpendicular stroke expresses *d* and *t*; a stroke inclined to the left stands for *g* hard, *k* and *q*; a small circle is the character for *f*, *th*, and *v*, &c. &c.

One of the most important rules in short hand is, that *all words should be written as pronounced*, without any regard to orthography. Several other general rules were particularly enforced by Mr. Dangerfield, such as uniformly expressing the terminations *tious*, *cious*, &c. by the character for *s* only :—*ble*, *bly*, &c. by *b* only :—the word *self* and its compounds *himself*, *herself*, &c. also by *s* only. He observed, that in many instances the pronouns might be omitted, and gave several examples in which a single letter would express an entire word quite intelligibly : thus "light and darkness" might be written "light and d ;" and brother and sister was equally intelligible if written "brother and s." Many other instances of similar abbreviations might be adduced, but it should be remarked that *sentences* ought to be abbreviated by long hand, and *words* by short hand. In allusion to the difficulty of reading short hand notes after a considerable lapse of time, the lecturer stated that when Dr. Doddridge died, he left behind him a great number of MSS. in short hand, a considerable portion of which his pupils were unable to decypher. If in this instance the use of vowel strokes had been adopted, not a word would have been lost. Mr. Dangerfield then introduced a variety of remarks on the method of teaching children to write, and the advantage of instructing them in short and long hand at the same time. From this subject he digressed into a series of observations on the impropriety of clogging the memory of the pupil with too many grammatical rules before they commence translating into a foreign language; and these remarks led to a disquisition on the utility and practicability of establishing an *universal language*.

The utility of the art of stenography is so obvious that no arguments are necessary to enforce it. The advantages of secrecy, expedition, and compressibility (if the term may be allowed) are united in its attainment; and this is so easy, that if a pupil were to commence learning short hand and long hand together, he would acquire the former soonest. Persons are deterred from attempting to learn it by the complication of characters which appears in different systems; but the adoption of a few simple characters* to express the consonants, obviates this difficulty. The utility of short hand is evident from the comparatively small space it occupies, and from the facility with which it enables persons to make extracts from books. If the lecturer were asked whether his system would enable an individual to follow a speaker, h should without hesitation answer in t affirmative. His system was reduced to knowledge of about 12 characters and

rules, 20 of which were essential, and the remainder useful. One great advantage was the addition of the *vowel strokes*, which, though not essential to the *writing* of short hand, were extremely useful in *reading* it at a future period. Mr. Dangerfield concluded by observing that persons learning short hand should write a little every day, and at the end of a month they would find that they had made considerable progress.

We beg to add that Mr. DANGERFIELD read his lecture from his own short hand notes, and that the fluency and rapidity with which he delivered it, afforded the best comment on the utility of the vowel strokes. The utterance of the lecturer was indeed so extremely rapid, that we must plead this circumstance as an apology for the imperfect sketch we have given of his remarks; for we doubt whether the most able practitioner upon his own excellent and expeditious system would have succeeded in keeping pace with him.

MR. WALLIS'S FIFTH AND CONCLUDING LECTURE ON ASTRONOMY.

COMPARATIVE DISTANCES, &c. OF THE PLANETS FROM THE SUN—TELESCOPIC APPEARANCE OF THE SUN—MOTION AND NATURE OF HIS SPOTS—SOLAR AND SIDEREAL TIME—EQUATION OF TIME—PHENOMENA OF JUPITER AND HIS SATELLITES—THE GEORGIAN PLANET—COMETS—THEIR MOTION IN THEIR ORBITS—SIDEREAL SYSTEM OF THE UNIVERSE—CONCLUSION.

FRIDAY, JUNE 24.

MR. WALLIS this evening resumed his able and comprehensive survey of the solar system, by observing that while the planets are all situated at different distances from the sun, and perform their revolutions round him in different periods, it is found that one constant and invariable similarity prevails, viz. that the squares of the times in which they revolve are as the cubes of their distances from the sun. That is, if the square of the time occupied by any planet in completing its orbit be compared with the square of the time occupied by another, the cubes of their respective distances will bear the same relative proportions to each other. This rule applies, not to one only, but to all the planets, and hence it follows that if the distance of one be correctly ascertained, that of the rest may be inferred. By observing the transit of Venus, the earth's distance from the sun was found to be 95,000,000 of miles, and the distances of the other planets are traced by a reference to this rule.

To exhibit at one view the relative distances and magnitudes of all the planets, Mr. Wallis directed the attention of his hearers to a cord, stretched across the curtains nearly the whole width of the lecture room. At one extremity of this cord was placed a white globe, representing the sun, and smaller balls were fixed upon the cord at proper intervals, shewing in regular succession the planets Mercury, Venus, the Earth, and Mars; then the four newly discovered planets, next to which followed Jupiter, Saturn, and finally the Georgian planet, which is upwards of 1800 millions of miles from the sun. The distance of the earth from the sun, as ascertained by the transit of Venus, is greater than had been anticipated. It was known that the parallax of the sun was less than 10 seconds, but as it was found to be only $8\frac{1}{2}$ seconds, and as double the horizontal parallax is the angle subtended by the diameter of the earth, it follows that the earth would be seen from the sun under an angle of little more than 17 seconds of a degree.

Mr. Wallis now displayed a splendid transparency, representing the telescopic appearance of the sun on a very large scale, with several of the spots which are sometimes seen upon its surface. When the sun is inspected with a telescope, his disc appears of a *mottled* character. His spots are only seen occasionally, but the mottled colour always, and though its appearance varies, it never assumes one uniform colour. The sun appears to revolve on his axis in about $27\frac{1}{2}$ days, but his actual revolution is performed in a shorter period, and this difference arises from the motion of the earth round the sun in the same direction. He revolves at an angle of about 8° from the plane of the ecliptic. Sometimes the spots proceed in a straight line upwards, and sometimes in a straight line downwards. Sometimes they describe a curved line upwards, and at other times a curved line downwards. Their motions therefore prove that the sun is a globe, and that he revolves on his own axis. Rotation then appears common to all the celestial bodies, for none of them have been found without it. Probably the whole solar system is in motion, for near the constellation Hercules the fixed stars appear during the last tury to have diverged from each other, while at the opposite point of the heavens, they become nearer, and these appearances would be the necessary consequence of a change in the relative situation of the solar system. We see therefore that all bodies

revolve, and upon the principles of gravitation, if one moves the whole must move. It is not supposed that there exists some immense mass of matter round which they all revolve, but that they all perform their revolutions round some general centre of gravity. As the moon revolves round the earth as her centre, the sun is the centre round which the earth and the planets revolve; and perhaps the sun itself, with all the myriads of stars that spangle the canopy of heaven perform similar revolutions, and are alike influenced by the wonderful and mysterious principle of gravitation.

The sun therefore is the centre of our system, for the fixed stars are not supposed to belong to it, though some astronomers have conceived it possible that comets may revolve round the fixed stars as well as round the sun. The diameter of the sun is 886,000 miles, and his magnitude 1,375,000 times that of the earth; but as his specific gravity is four times less, his actual *mass* or *weight*, if it may be so expressed, exceeds the mass of the earth about 330,000 times. Those planets which are nearest the sun, as Mercury and Venus, possess the greatest density, and it is found that the planets decrease in density as their distance from the sun increases. The densities of the planets are determined upon the principles of gravitation, by comparing the velocities with which their satellites revolve round them, with the velocity of the moon's revolution round the earth. Upon comparing, for example, the velocity of the satellites of Jupiter with that of the moon, it is found that they do not revolve with a rapidity proportionable to the superior magnitude of Jupiter to that of the earth, and it is therefore concluded that Jupiter is not so dense as the earth. The density of those planets which have no satellites is ascertained in a different manner, by observations on the *disturbing force* with which they act upon each other's motion in their orbits.

The spots on the sun's disc do not constantly preserve the same form, for a large spot is sometimes observed to break up suddenly and divide itself into several smaller ones. On their first appearance at the side of the sun they are seen foreshortened, in consequence of his globular form, and increase in size horizontally as they approach the centre, after which they diminish as they advance towards the opposite side for the same reason. Of the nature of these spots there has been a diversity of opinions, the most probable of which is that the sun is an *opaque mass*, surrounded by an intensely luminous matter, with the nature of which we are unacquainted. If we suppose this matter to be composed of different strata, and that these by any cause become broken, we shall see through the openings portions of the opaque body of the sun, which will appear like spots upon his surface. Some of these spots are of immense size. The lecturer had himself seen with his naked eye (protected only by a medium which diminished the intensity of the light) a spot which was at least 40,000 miles in diameter. Previous to the appearance of a dark spot, the part of the sun on which it appears is intensely luminous. Sometimes their appearance is very sudden, for the sun has frequently risen entirely free from spots, and several have been seen on his disc before he set. Some have imagined his spots to be mountains, but this supposition is not so probable as that they are portions of the sun's opaque body, seen through cavities in the luminous matter which surrounds it.

After observing that the sun is of sufficient magnitude to act as a centre to all the planets, Mr. Wallis proceeded to examine the generally received opinion that he is the source from which they derive light and heat. He stated that frequent instances occur of the presence of light without heat, and of heat without light. The greatest concentration of the moon's light produces no sensible elevation of temperature, and a mass of iron may be powerfully heated without generating light. It is probable that heat consists of matter collected at the surfaces of the planets themselves, rendered sensible by an emanation proceeding from the sun; for if we suppose that the sun continually sends off *caloric* from its surface, infinitely more must be expended than is necessary for the planets, which are mere specks in comparison with the immense space in which they move. If on the contrary, we suppose the fluid emanating from the sun to operate only as the *cause of heat*, there will be no waste; and indeed when we compare the vast distance of the Georgian planet with the proximity of Mercury and Venus, the disproportion in their respective quantities of heat, upon the first supposition, is so great as apparently to detract from the universal harmony of the system; whereas, upon the second hypothesis, there may exist something like a mean temperature among them all.

The next transparency exhibited in a strikingly beautiful manner the comparative magnitudes of the sun, the planets and their satellites. The sun was represented by a brilliant circle, four feet in diameter; and the various planets, according to their proportionate sizes, incircled it at some distance from its circumference. This elegant transparency was also ingeniously contrived to shew the comparative magnitudes of the

vast globe of the sun himself, as seen from the different planets which revolve round him; for his surface was divided into a series of concentric circles, of various colours, each of which, as they diminished towards the centre, exhibited the progressive diminution in his apparent diameter, from the exterior circle, representing his magnitude as seen from the planet Mercury, to the diminutive dark spot in the centre, which exhibited his comparative size to a spectator at the immense distance of the Georgian planet. From the amazing disparity in the proportion of light and heat which the planets must respectively receive from the sun, according to the forcible illustration presented by this transparency, Mr. Wallis took occasion to repeat his previous arguments that heat, and probably light exist in the planets themselves, and are merely called into action by an emanation from the sun, and hence he inferred the probability that the rest of the planets may be inhabited by beings in some degree similar to ourselves.

The machinery of the next transparency was prepared for the purpose of illustrating the difference between *solar* and *sidereal* time. It represented the northern hemisphere of the earth, at a distance above which appeared the sun, with a brilliant star beyond it and in conjunction with it. The motion of the earth on its axis is found to be always regular, and if the time be measured by the sun, the earth revolves on its axis in the course of the year 365¼ times with respect to him; but if it be reckoned by a star, the earth revolves 366¼ times in the same period. This difference between solar and sidereal time is occasioned by the motion of the earth in its orbit at the same time that it revolves on its own axis. To explain this more clearly by means of the transparency, the earth was made to revolve on its axis, while the sun moved towards the east, (so as to represent its apparent motion, owing to the real motion of the earth eastward) and the star remained in the same situation in the heavens. Before the machinery was put in motion, Mr. Wallis pointed out the situation of Great Britain upon the hemisphere, and desired the audience to suppose that it was exactly noon by the sun and the star, both of which were on the same meridian. The earth then revolved on its axis, while the sun removed towards the east, and it was distinctly seen that when the earth had completed one revolution with respect to the star, which was again on the meridian of Great Britain, it was necessary that it should revolve some distance farther before it arrived at the point where the sun was on the meridian, because the motion of the sun towards the east had changed its position in the heavens relative to the star. It was therefore evident that the solar and sidereal days were of different lengths, and that solar time must always exceed sidereal time. The earth's real revolution on its axis is completed in 23 hours, 56 minutes, and 4 seconds, while its revolution with respect to the sun occupies 24 hours, and thus it has 366¼ sidereal days in the course of the year, while the solar year consists of only 365¼.

The difference between real and apparent time is occasioned by the motion of the equator at an angle with the plane of the earth's orbit, and also by the elliptical form of the latter, in consequence of which the earth moves more rapidly in some parts of its orbit than in others. Astronomers therefore suppose an imaginary sun to be moving in the equator, while the real sun moves in the ecliptic; and as the obliquity of the equator to the ecliptic sometimes occasions the real sun to gain upon the imaginary one, and sometimes the latter to gain upon the former, the adjustment of the difference between the two motions is called the equation of time. Four times a year, however, the time pointed out by each is the same. The equation of time is rather a complicated subject, for as the year consists of nearly 365¼ days, it is necessary to have a leap year once in four years; but an additional day every four years is too much, and therefore three leap years are omitted every five centuries, according to the Gregorian Calendar, so called from Pope Gregory XIII. under whose auspices it was established. In the year 1800, a controversy took place respecting the omission of the leap year, but the disputants forgot that this was one of the centuries agreed upon. Agreeable to the Gregorian Calendar, the variation is little more than two hours in five centuries, and this may be sufficient to accumulate till it amounts to a day, before which several thousand years must elapse.

Having, in his previous lecture, been obliged to postpone his illustrations of the phenomena of the planet Jupiter, Mr. Wallis introduced the subject in this place, and observed that this planet which is the largest in the system, revolves between Mars and Saturn; and till the discovery of the four small planets within a few years between Mars and Jupiter, it was supposed that the latter was the only planet whose orbit was situated between those of Mars and Saturn. The telescopic appearance of Jupiter with his four satellites was exhibited in a beautiful transparency, representing the remarkable belts which are seen on his surface parallel to his equator, and are

supposed to be owing to the velocity of his rotation on his axis, which is completed in nine hours and fifty-six minutes, so that a point at the equator moves through 41,000 feet in every second of time. His diameter is about 90,000 miles, and his distance from the sun about 490,000,000.

The four satellites, or moons of Jupiter, exhibit the singular phenomena of *transits*, *immersions* and *emersions*, which Mr. Wallis now proceeded to exemplify by means of the admirable machinery which communicates motion to his transparencies. One of the satellites was made to revolve round the body of the planet *horizontally*, so as to shew all these phenomena in succession. It first proceeded in its orbit till it passed *behind* the planet, and the moment when it disappeared from the spectators represented its *immersion*. Observations on these immersions are extremely useful in ascertaining the longitude of a place; for if we suppose the Nautical Almanac to state that the immersion of a satellite takes place at 10 o'clock at Greenwich, and that to an observer at another place, the same immersion occurs at 9, he is enabled to decide at once that he is 15° east of Greenwich, and if the immersion happens an hour later instead of earlier, he is as many degrees west. The satellite having now proceeded through that part of its orbit which was behind the planet, and involved in its shadow, made its appearance on the opposite side and exhibited its emersion. It was now approaching the earth, and gradually continued its course till it passed before the planet, and represented a transit. As the planet and the satellite are both opaque bodies the latter during its transit will throw a shadow on the surface of the former, and this was beautifully shewn in the transparency, for when the satellite appeared to touch the limb of the planet at the beginning of the transit, in a few moments its shadow was seen traversing the surface of Jupiter like a small circular spot, which proceeded till the end of the transit, when it passed off on the opposite side, and the satellite reappeared in its former brightness.

All these phenomena occur in the course of 42 hours, though they are not always visible, and they are common to all the four satellites, two or three of which are sometimes eclipsed on the same evening. Mr. Wallis now prepared another transparency to elucidate more fully the *immersions and emersions* of the satellites, but observed that as the motion in this instance was vertical instead of horizontal, the *transits* would not be visible. The transparency exhibited a brilliant representation of the planet, whose belts in this view appeared circular; and the light of the sun shining from the right, that half of his surface was illuminated, while his shadow, (which from his immense distance from the sun is 33 millions of miles in length) was thrown on the left. The satellites were seen at their relative distances from the planet, and upon being put in motion, described their respective orbits with a rigid adherence to their actual velocities in nature. The effect of this luminous exhibition of the eclipses of the satellites was beautiful in the extreme, and elicited reiterated plaudits from the members. As the four moons revolved round the planet, they passed through the shadow and were eclipsed at every revolution, and as they moved at different distances and with different degrees of velocity, their immersions sometimes occurred at considerable intervals, and sometimes two or three were eclipsed nearly at the same time. Mr. Wallis stated that the fourth, or most distant satellite sometimes escapes an eclipse in its revolution, and he added, that on account of the axis of this planet being nearly perpendicular to the plane of its orbit, it had no vicissitude of seasons during its journey round the sun, which occupied about twelve years. In this respect it resembled our moon. Jupiter's spheroidal figure was exhibited by a transparency, when his equatorial diameter was found to bear to his polar diameter a proportion of 14 to 13. The satellites of this planet are observed to revolve on their axes in the periods in which they respectively move round Jupiter, which has already been shown to be the case with our moon in its revolution about the earth.

The planet Saturn having been illustrated in his last lecture, Mr. Wallis now exhibited a transparency of the Georgian planet, which is the most distant in the system and presents few phenomena to the telescope, except its six satellites, which revolve round it in a direction almost perpendicular to the ecliptic. The Georgian planet is 1800 million of miles from the sun round which it revolves in 84 years, and from its immense distance, subtends an angle of only four seconds. Before this planet was discovered by Herschel, it was supposed, from the perturbations observed in the orbit of Saturn, that another planet existed beyond him, and this circumstance affords a striking proof of the correctness of the calculations upon which the science of astronomy is founded. The period of its rotation is not known. Its diameter is about 35,000 miles.

Besides the planets, there are other bodies in the solar system called COMETS, which

seem to obey the same laws as the planets, and to revolve round the sun as their centre; that is, they move in elliptical orbits, in which the sun is situated in one of the *foci*. Mr. Wallis exhibited a transparency, representing a small comet which appeared in July, 1819, and observed that the *nucleus* is the brightest part of the comet, and that they are supposed to contain very little matter, as one of them passed in the year 1770 very near the satellites of Jupiter, without producing any visible disturbance of their motions, small as they are.

The comet of 1811 was the most beautiful that has been seen for many years, and was extremely interesting, not only from its appearance, but from the length of time it remained visible. Of this comet the lecturer exhibited a large transparency, and stated that the extreme length of its tail was 40 millions of miles, but it was of a very attenuated nature, as stars were visible throughout every part of the comet except the *nucleus*. It is a singular circumstance that the tail of a comet is always turned *from* the sun; the nucleus therefore *precedes* the tail as it approaches the sun; and *follows* it when it is receding. If then we suppose the emanation proceeding from the sun to be of an *electrical* nature, and the tail of a comet to resemble it, the action of the sun upon the comet would seem to obey the law by which *similar electricities repel each other*.

Mr. Wallis now prepared a magnificent scene representing the motion of a comet in its orbit. A brilliant sun occupied the lower part of the transparency, and the comet of 1811 appeared at the top in its *aphelion*, or at its greatest distance from the sun. The apparatus was then put in motion, and was contrived with such admirable skill by means of a *conical* movement, that the comet proceeded to describe a very eccentric ellipsis, the velocity of its motion increased as it approached the sun till it reached its *perihelion*, or its least distance from that luminary, after which its velocity gradually diminished as it described the other half of its orbit, till it arrived with a very slow motion at the point from which it started. The direction of the tail was also changed during its progress so that it was continually turned from the sun. The comet of 1811 was remarkable for the curvature of its tail, and its separation into two distinct streams of light.

After having thus completed his hasty sketch (as he termed it) of the general elements of the solar system, Mr. Wallis observed that he should now briefly notice the sidereal system of the universe. The fixed stars, which shine by their own light, do not belong to our system. They are found collected into clusters, called nebulæ, in different parts of the heavens, and of these nebulæ Sir W. Herschel discovered 2500 which were not known before. Mr. Wallis exhibited a transparency, representing several of them of various forms, and appearing like luminous clouds. The most beautiful of these nebulæ is the milky way, composed of an infinite number of stars, of which the sun is supposed to be one. The subject was indeed of a nature so vast and unbounded that the lecturer scarcely dared venture upon its illustration. We are acquainted with the existence of about 80 millions of fixed stars, and the number may be infinitely greater, for light appears in many parts of the heavens which the most powerful instruments have not succeeded in distinguishing into stars. By observations on the fixed stars and the satellites of Jupiter, light is found to move with a velocity of 200,000 miles in a second of time, yet so amazingly distant is the nearest of the fixed stars, that light though moving with a velocity of which the bare idea is overwhelming to such faculties as ours, would be two years in arriving at the earth. What ideas then does the contemplation of this subject give us of the immensity of space! Yet when we reflect upon the infinite perfection of HIM whose power produced the whole, that which appears a difficulty to our finite comprehension is no objection to the fact.

Mr. Wallis, having thus terminated his splendid illustrations of the sublime and attractive science of ASTRONOMY, addressed the audience in nearly the following terms:

I have now, gentlemen, submitted to your notice what I consider the most important topics of this science; in the elucidation of which it has been my endeavour to reduce or refer them to laws strictly *mechanical*. This has by some been supposed to verge towards atheism. But I shall now show that such a conclusion is altogether unwarranted. All the changes of *matter* are instances of *motion*. Now motion is only a contingent circumstance to matter, as matter may be either at rest or in motion: though it may be objected that we are not acquainted with a single instance of matter at rest absolutely, since our own planet with the others, is in rapid motion in space. But different parts of our planet have different degrees of velocity, and the velocity of the different planets is found to differ very considerably; which proves that motion is not an essential property of matter; for there can be no degrees in that which is essential; that which is essential is absolute and indispensible:

motion then includes the idea of power; but power is not a property of matter,—power is an attribute of mind; motion then conducts us through a series, ultimately to a vital origin;—to mind!—Besides then the evidences of design which we trace in ASTRONOMY, and which are the very demonstrations of intelligence, the fact of motion conducts us beyond material agency.

In our efforts to communicate motion to matter, we employ the principle of *gravity*, or that of *elasticity* which is perhaps itself resolvable into the former;—this, independent of the vital principle, is perhaps the only source of *momentum*. Now that which we call physical astronomy includes the motion of large masses of matter, and from the very remarkable analogy between the motion of the moon and the descent of heavy bodies at the surface of the earth, as it is reasonable to suppose that matter is subject to the same laws throughout the universe, we extend by a simple act of generalization this mechanical principle from the smaller to the greater,—from the earth to the heavens.

We find all the celestial movements to be curvilinear, and we have proved curvilinear motion to result from the composition of an *equable* and *accelerative* force. Now gravity supplies this latter kind of force, and if we suppose the *projectile*, or equable force to have been communicated to each of the bodies, it is just reasoning to infer from the universal prevalence of gravity, that it is employed as the great agent in the material universe. Perhaps if our penetration could extend to the analysis of the subtle processes of chemical action, we should discover even this to be a delicate modification of the mechanical principles. And it seems to me that in our investigation of material phenomena we shall never go beyond their *mechanical affections*;—with the nature of *ultimate causes* or efficiency, our faculties are not adapted for acquainting us.

But perhaps our argument would be more correct if we regarded our science of mechanics, as a minute and subordinate modification of those principles, which in their unrestricted perfection are employed in the regulation of the celestial phenomena. For the unequalled simplicity and rigid perfection of the mechanical laws would suggest their universality, and render it more than probable that their agency would be employed in the most extensive and elementary processes of nature.

In Astronomy then it is the business of the philosopher to seek for principles and laws the most *universal* and the most *simple*;—these we discover in our science of mechanics and laws of motion. But the perfection of a *law*, marks the perfection of the *lawgiver!* and the ineffable skill which can effect by the same means operations the most minute and the most vast,—the most simple and the most complicate, discloses to us a wisdom the most transcendent and divine. Our argument then proceeds on facts, and our conclusion is in harmony with sound reason, and enables us with the firmest step to trample on the mean and unphilosophical system of the atheist. In referring therefore the celestial motions to mechanical principles, we do but suppose the Deity to employ principles of his own ordination, according to laws which he himself determined;—which is in perfect consistency with the immutable character of his nature.

When surveying the magnificent system of the universe, it is amazing that man should have been able to discover so much respecting the laws of its movements; so that the relative position of a planet can be determined for any time with the greatest precision. This is a power which knowledge has conferred on industry. But there was a period when, through superstition and ignorance, the beautiful heavens were regarded with dread, and their changing phenomena struck men with consternation. An eclipse of the sun was regarded as an omen of calamity, and the magnificent comet was beheld with fearful suspense in the cerulean vault of heaven, as the minister of Almighty vengeance,—

> ——"And from his horrid hair
> "Shook pestilence and war!"

In the time of Pope Callixtus, a great comet made its appearance, which excited much perplexity and alarm. He ordered a prayer in which the *comet* and the *Turks*, whose arms were then successful against the church, were included in the same anathema. The banishment of such impious absurdities we owe to the progress of true philosophy. It is to be regretted, that in the present day of improvement and scientific information, a respectable association of this metropolis, one of the branches of its corporation, issue, *for the sake of gain*, an Almanac in which the nonsense and absurdities of ASTROLOGY are circulated throughout this kingdom, and sent invested with the sanctity of mystery into the circles of the credulous and illiterate!—Besides the impious pretensions which astrology includes, it is a pity that the intellect should be encumbered by such rubbish, or the feelings clouded and depressed by its denunciations. And shall the noble and sublime science of astronomy, in the country which gave birth to her Newton, be degraded by

a fellowship with the cant of vagabond gipsies, and the artifices of cozening impostors? Are the divinely simple and harmonious arrangements of the UNIVERSAL FATHER, to be regarded as the arbiters of the fate of his intelligent creatures, or the instruments of his vengeance for their destruction?—No! they are the tokens of Almighty power and unsearchable wisdom, and to a reflecting mind they evince the boundless character of his goodness:—"the heavens declare the glory of GOD,"—not his vengeance.

All creation is replete with manifestations of the attributes of the Almighty Spirit.—If, stationed on the summit of some lofty mountain, we trace the first dawn of orient twilight, and watch the stars of night dissolving in the distant radiance of the sovereign of day; when his approach irradiates the luxuriant and boundless landscape,—where is the bosom that does not glow with gladness in contemplating HIS beneficence, whose power thus reproduces the joyous light, and whose exuberant bounty has clothed nature with verdant freshness, and decked her with matchless beauty, scattering his blessings thick as the refreshing dew drops of the morning?—Or if from some mountain eminence, we view the sun arrayed in his western glories, and watch the day softly sinking into the dimness of evening,—are we not wrapt in the delightful serene of meditation?—and when the deeper quiet of midnight, with its myriads of suns and systems adorning the azure expanse of heaven, invests us,—does not the silent majesty and ethereal grandeur of the scene inspire us with a sacred awe of HIM, who "bringeth out their hosts by number, and for that he is strong in power, not one faileth?"—Yes,

The spacious firmament on high,
With all the blue ethereal sky,
And spangled Heavens, a shining frame,
Their Great Original proclaim:
Th' unwearied sun, from day to day,
Doth his Creator's power display,
And publishes to every land,
The work of an Almighty hand.

Soon as the evening shades prevail,
The moon takes up the wond'rous tale,
And nightly to the list'ning earth,
Repeats the story of her birth:
While all the stars that round her burn,
And all the planets in their turn,
Confirm the tidings as they roll,
And spread the truth from pole to pole.

What though in solemn silence all
Move round this dark terrestrial ball!
What though nor real voice nor sound
Amid their radiant orbs be found!
In reason's ear they all rejoice,
And utter forth a glorious voice,
For ever singing as they shine,
"THE HAND THAT MADE US IS DIVINE!"

Mr. WALLIS recited this beautifully appropriate hymn with a degree of eloquent animation which produced a powerful effect upon the audience, who appeared to participate in the feelings of devotion which the exquisite lines of Addison are so admirably calculated to excite. The lecture room rang with the acclamations of the members as Mr. Wallis withdrew, and their repeated plaudits evinced the deep and intense interest with which they had partaken of the intellectual feast which his lectures had afforded. We have repeatedly expressed our admiration of the splendid apparatus employed by Mr. Wallis, the whole of which, we understand, was designed by himself, and executed by his own hands.

IMPORTANT NOTICE.

At the close of Mr. WALLIS's lecture, Dr. BIRKBECK announced to the members that they had now arrived at the termination of their proceedings in the place where they were at present assembled, and where, with very indifferent accommodation, they had listened to several philosophical courses of lectures on the various branches of physical science. When they next met, it would be in a place where he trusted they would experience far superior accommodation. They were all aware that the NEW THEATRE in Southampton Buildings was nearly completed, and as it would be ready for their reception early in the ensuing month, the appointment of the time of opening it had only been delayed in consequence of a circumstance already hinted at—the probability of the presence of an Illustrious Individual upon that occasion. He had now the satisfaction of stating that he had received a communication from HIS ROYAL HIGHNESS THE DUKE OF SUSSEX, mentioning Friday the 8th of July as the day when his Royal Highness could attend, and the members would therefore consider the evening of that day, at the usual hour of half past eight o'clock, to be definitively fixed as the period for opening the NEW THEATRE OF THE INSTITUTION. It was not intended that a formal lecture should be delivered on that evening, but merely that some ceremony, appropriate to the occasion, should be observed. With respect to future lectures, no decisive arrangements had yet been made, but as a communica-

tion had been made to Professor Millington,* it was probable that the first course of lectures at the New Theatre would consist of an extensive series on a topic interesting to the whole of the members, viz. THEORETICAL and PRACTICAL MECHANICS.

PRESENTATION OF A SILVER SNUFF-BOX TO MR. BLACK BY HIS PUPILS IN THE FRENCH SCHOOLS.

We mentioned a few weeks since that a meeting of Mr. Black's pupils had been held at the London Mechanics' Institution, to take into consideration the propriety of presenting to that gentleman some appropriate testimonial of their gratitude and esteem, and we are happy to add that the resolutions then entered into were promptly carried into effect, and an elegant SILVER SNUFF BOX, value Ten Guineas, was prepared for Mr. Black's acceptance. The following is a copy of the inscription on the box:

TO JAMES BLACK, ESQ.
This testimonial of respect and gratitude
for his instruction
upon his admirable system in
THE FRENCH LANGUAGE,
delivered gratuitously in the
LONDON MECHANICS' INSTITUTION
is presented by 72 of
his pupils.

A second meeting of the pupils was recently held, upon which occasion the box was presented to Mr. Black by Mr. Fayerman, who complimented him in a handsome speech on the assiduity and ability with which he had instructed his pupils, according to the principles of his very superior system.

A copy of the resolutions and inscription, with a list of the pupils by whom the box was given, was also presented to Mr. Black by Mr. Reynolds. This piece of writing, executed by Mr. R. in his best style of penmanship, was handsomely framed and glazed, and was presented by that gentleman at his own expense.

Mr. Black in returning thanks, expressed in forcible terms, his gratitude to his pupils for the handsome mark of respect they had shewn him, and briefly detailed the origin and progress of the system upon which he had instructed them.

Thanks were then voted to Robert M'William, Esq. who presided at the meeting, and to the Committee for their exertions, after which the meeting adjourned.

SURREY LITERARY INSTITUTION.

The first half-yearly general meeting of this institution was held at the Mansion House, Camberwell, on Thursday evening the 16th ult., the Rev. John Vane, A. M. minister of St. George's church, Camberwell, in the chair, supported by Drs. Birkbeck, Walshman, and Whiting, Messrs. Tatum, Roberts, Hardy, and several other gentlemen of eminence resident in the vicinity.

The report of the committee was first read by the honorary secretary, and contained an interesting account of the rise and progress of the institution, as well as its future prospects, which were highly encouraging. It stated, that although it had been opened scarcely five months, yet that the income was equal to the expenditure on its *present* footing; that the reading-room was provided with six daily newspapers, the principal monthly journals, the London Mechanics' Register, Literary Gazette, &c. that the balance of cash in hand was 165*l*. (since increased to 180*l*.) and concluded by recommending, that in consequence of the very promising state of the society, the price of shares should be raised to new proprietors, and the annual payment to subscribers.

The report of the finance committee and the laws of the institution having been read, were unanimously agreed to, and ordered to be printed.

The officers and committee for the year ensuing were then elected by ballot, and apologies were made for the unavoidable absence of W. J. Denison, Esq. M. P. for the county, Samuel Favell, Esq. treasurer, and several other gentlemen.

The Rev. John Vane (having been elected president for the ensuing year) then rose and delivered an excellent and animated address, in which he adverted to the beneficial effects of institutions of this description. He recommended that the library should as soon as possible be furnished with some of the best editions of the classics, observing, that most of the eminent names in the literary world had been scholars; passed a warm encomium on Bacon, Locke, and other great luminaries of their age; advised that the library should be strengthened in the departments of philosophy and history, particularly in the history of our own country; paid a just tribute of admiration to the names of

* We have since understood that Professor Millington is at present in Cornwall, and that some doubt exists as to the practicability of completing this arrangement.

Shakespeare, Spencer, Milton, Gray, &c.; congratulated the meeting that this society was formed without introducing party feelings of a theological nature, adding "that whenever the spirit of party prevailed, the spirit of literature fled;" and concluded his address, which was received throughout with great applause, by requesting every proprietor, individually, to use his best efforts to promote its advancement.

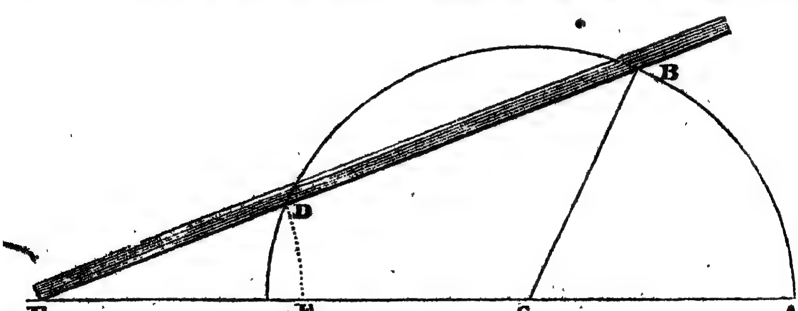
Dr. Birkbeck, in rising to move the thanks of the meeting to their excellent and worthy chairman, could not help congratulating them upon the favourable report that had been laid before them, and upon the pleasing anticipations in which they must indulge on their future prospects. He took this opportunity of thanking them for the honour they had done him in a second time electing him a Vice-President, and begged to assure them, that he was a warm friend to the institution; and although from circumstances of a local nature, and from other causes, he had hitherto been enabled to give little beyond his good wishes, yet he trusted they would not estimate the future by the past, as it was his intention to give more substantial proofs of his regard. (Applause.) He was extremely happy to observe that the original plan of the institution had been extended: when he attended the meeting held at the Grove House, in December last, for its formation, he took the liberty of suggesting that lectures should be given; his suggestion was attended to, and a series of lectures equally creditable to the society, and amusing and instructive to the members, had been delivered. He was also happy to notice the determination of the managers to recommence them in the autumn. From the unanimity and good feeling displayed, he also felt assured of the prosperity of the institution, and anticipated the most beneficial results from the accession of the reverend Chairman to the number of its members. (Great applause.)

Thanks were then unanimously voted to the Rev. John Vane, "for the zeal, urbanity, and talent with which he had conducted the business of the evening," when the Chairman having returned thanks, the meeting, which was most respectably attended, adjourned.

TRISECTION OF AN ANGLE.

To the Editor of the Mechanics' Register.

Sir—You know it is said by Geometers that there is no geometrical method of trisecting an angle, but I find it may be effected in the following manner, although some may say it is rather *mechanical* than *geometrical*. But I confess I cannot see why it does not deserve to be considered as much geometrical as any other problem where compasses and ruler must be used



Let it be required to trisect the angle B C A, continue A C at pleasure to (or beyond) E, and set the length of the radius C B, from the end E of a ruler E B from E to D; then stick a pin at B, and laying the ruler to B and keeping the end of it on the right line E C A, slide its edge upon B till the mark D touches the semicircle; which done, draw the right line E D B along the ruler's edge, and the angle D E F will be equal to one-third of the angle B C A.

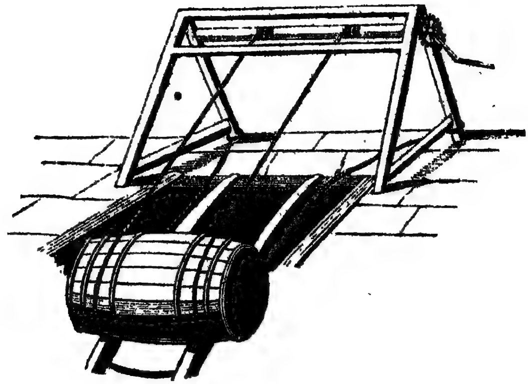
Perhaps as your valuable work is devoted to almost every science, you will not object to the insertion of the above.

Kilburn, Yorkshire. R. YELLOW.

GOTLIEB'S COLLAR CRANE.

Sir—As part of your useful Register is appropriated to the insertion of the lectures, I have sent you a representation of the collar crane, invented by Gotlieb; thinking it

may be useful in illustrating the combination of four of the mechanical powers in raising a weight. The winch (or *lever* power) with the pinion impels the *wheel and axle*; the two ropes attached to the axle and legs of the crane, and doubled round the un-

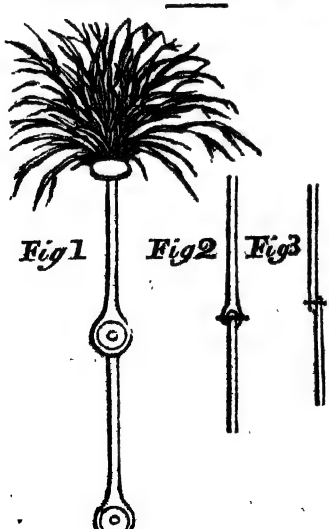


der part of the cask, are the (single) *pulley* power; and the cask is rolled up the *inclined plane*.

Stays proceed from the crane and rest against the building before it, to prevent its being moved forward.

Yours respectfully,
J. WEBB, Engraver.

MACHINE FOR SWEEPING CHIMNEYS.



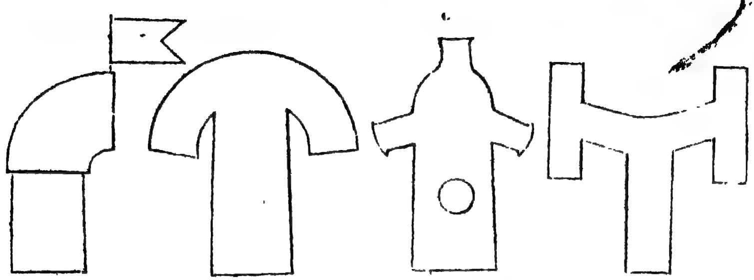
Sir—Having read in your valuable miscellany an account of the meeting for superseding the employment of climbing boys, I am induced to send you a sketch of a machine which I think will prove superior to that which is made of wooden tubes, and connected together by a rope. I propose to have the machine made of iron wire in about two or three feet lengths, jointed at each end and rivetted together, which will not occupy so much room as the former one, and if the joints are kept clean so that they may work free, I think the operation of sweeping may be performed in much less time, and with a great deal less trouble than it possibly can be with the wooden machine. Your insertion of this may probably induce some humane mechanics to look into the subject, and produce some machine superior to the one I propose, and will oblige your constant reader, HENRICUS.

Fig. 1, represents the front view of the machine, and Fig. 2, the side view, but instead of being jointed as in Fig. 1 and 2, it may be made as in Fig 3, to fold side by side instead of working between the ears as in the first figure.

ON SWEEPING CHIMNEYS BY MACHINERY.

Sir—At the meeting of the society for superseding the necessity of employing climbing boys (which is reported in No. 33 of the London Mechanics Register) it was stated that Mr. Smart's machine could sweep 95 flues out of a hundred, but that the remaining 5 could not be swept by the same

process by reason of their angular construction. I am surprised, after so many years trial of the machine, that no difficulty has been experienced in sweeping the *chimney-pots*. In some situations the pots for curing what are termed smokey chimneya are nearly as numerous as the conical shaped pots which are the best adapted for sweeping with the machine. I have made inquiries of several master chimney sweepers and they are all of opinion the clearing the soot from the extremity of the pot is of the greatest consequence to the drawing of the chimney. If I have been correctly informed, how is it possible for the machine to sweep the pots represented in the annexed engraving,



which are only a few of the numerous contrivances for the same purpose? Pots whose tops are designed to turn with the wind have a bar (for supporting the pivot) placed horizontally across the top of the pot.

Your much obliged servant,
J. Webb, Engraver.

EXPIRED PATENTS.

George Gilpin, for a machine for combing wool, and preparing it for spinning, and also certain improvements in the construction of a machine known by the name of a breaking frame, for drawing and clearing of the wool from the combs used in the first mentioned machine, and also a stove to be heated by fire or steam for the purpose of heating the said combs. Expired June 11.

Joseph Taite, Bryan Dorkin, and William Dixon, for machinery for finishing piece-goods or other flexible articles of the like description, by glazing, burnishing, graining, or making impressions upon the surfaces thereof respectively, as may be required. Expired June 11.

William Piper, for an improved mode of manufacturing gun skelps. Expired June 11.

Timothy Sheldrake, for certain wheels, which, when combined together, will constitute a moving power of great force, by the application of which to many engines, machines, and machinery, that are now set in motion by steam, wind, water, or animal power, the effect of the said known powers will be greatly increased, and the labour of men or horses that are now employed on the said engines, machines, or machinery, will be diminished; which wheels may be introduced, in part or in the whole, into many engines, machines, or machinery, for whatever uses they may be employed, instead of the wheels and pinions by which such engines, machines, or machinery, are generally kept in motion; and which wheels when so introduced, will work with much less friction, and much greater velocity, than those which are usually employed. Expired June 15.

TO CORRESPONDENTS.

For the information of those Correspondents who may not have observed the Notice in our last Number, we beg to renew our request that their future communications may be addressed to the Editor, at Mr. Gifford's Weekly Publication Office, Paternoster Row.

As the former communication from Mr. Jenneson never came into our hands, we cannot understand the object of his letter received this week.

Can Tyro-Mechanicus oblige us with another copy of the introductory part of his letter on the simple Lever Press? It was separated from the descriptive portion in preparing it for publication, and is mislaid.

From the great length of Mr. Wallis's valuable Lecture on Astronomy, and the pressure of other matter, we are reluctantly obliged to postpone the insertion of several communications till next week; when, owing to the temporary suspension of the lectures, we shall be able to find room for the favors of a number of our Correspondents.

LONDON:—Printed by COWIE and STRANGE, 24, Fetter Lane

THE LONDON
MECHANICS' REGISTER.

Remember that time is money. He that can earn ten shillings a day by his labour, and goes abroad, or sits idle one half of that day, though he spends but sixpence during his diversion or idleness, ought not to reckon that the only expense; he has really spent, or rather thrown away, five shillings besides.—Dr. FRANKLIN.

No. 39.] SATURDAY, JULY 9, 1825. [Price 3d.

IMPROVED PORTABLE STEAM WASHING APPARATUS.

Fig. 1

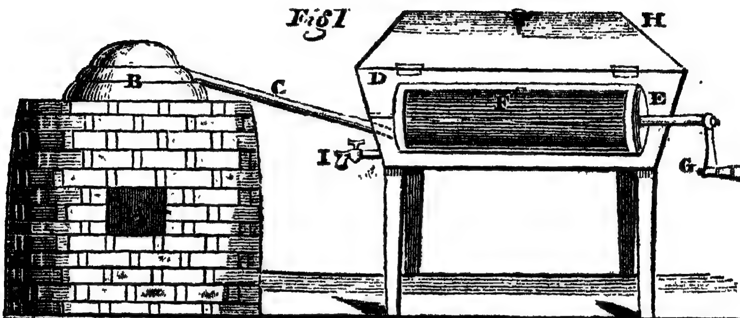
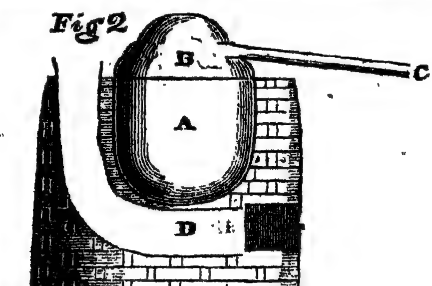


Fig. 2



To the Editor of the Mechanics' Register.

Sir,—Enclosed I send you the drawing of an Improved Portable Steam Washing Apparatus, (whether new to the public I cannot tell, but is original as far as regards myself,) which may be used in almost every family, and with very little additional expense, as any common copper now in use can be used, by having the lid and steam pipe made to fit it. As far as regards the trough, it is only to be made of wood, and air and water tight, and when in use is to be half filled with hot soapy water, and the steam to be made issue from the pipe into the trough; and by turning the cylinder by the hand, the clothes will be as well cleaned and with less expense than by the common mode, and will be done as well as by the London Patent Steam Washing Company; therefore, Sir, if you think this worth a place in your much-valued Register, its insertion will oblige your obedient and humble servant, HENRY WM. DEWHURST.

21, Francis-street, Tottenham-court-road.

EXPLANATION.

A, the door of the grate.

B, the head to the copper, and which receives the steam.

C, the steam pipe which conveys the steam to the trough D.

D, the trough into which the water and soap is put, and which must be made air and water tight.

E, a cylinder made of metal (wire) into which the clothes are put.

F, the opening into the cylinder E.

G, the handle by which the cylinder is turned.

H, the top of the trough, which when in use is to be well fastened down, by bolts, springs, or otherwise.

I, a cock to let off the waste water.

Fig. 2.—A section of the copper, &c.

A, the copper.

B, the head of the copper.

C, the steam pipe.

D, the copper flue.

MAIL COACH BOXES.

Sir—I wish through the medium of your widely circulated publication, to call the attention of the mail coach builders to the very dangerous state of the mail coach boxes, the side irons of which give no security whatever to the passenger; many accidents have in consequence occurred, two of which have been fatal. In the stages the irons are higher, and form a secure and comfortable seat. VIATOR.

PORTABLE STEAM, OR VAPOUR BATH.

To the Editor of the Mechanics' Register.

Sir—Allow me to offer a few remarks on the portable steam bath described in your present volume, page 59, and stated to be the invention of Admiral Brooking. It is not my intention to dispute the originality of the idea with the gallant admiral (though I tried the same principle two years since, and laid it aside as ineffective) but to prove he must calculate his lee-way on a bow line better than he has the effects of his vapour bath on the human constitution, or he will be to leeward of his port. The only difficulty of constructing a steam bath which shall be effective as a medical agent is, the levity of steam gives it so strong a tendency upward, that it is absolutely necessary some precaution should be taken to prevent its too rapid escape from below, or it will be impossible to maintain an equilibrium of temperature between the top and bottom of the bath; and it is not only positively requisite that an equilibrium should be maintained, but that an inverted ratio of temperature to that which would be produced by the unrestrained escape of steam into the space confined by the cover, should exist; as every one acquainted with the sanguinary system will agree, that placing the head in a higher temperature than the lower extremities, when the system is in a state of excitement from the effects of the bath, would cause a determination of the vital fluid to the brain, the vessels of which would become so distended as to cause in all cases considerable inconvenience, and in many very unpleasant results. The gallant admiral appears aware of the necessity of keeping the feet warm, as he uses "two tubs of lukewarm water," the temperature of which would be about 85, which would produce a bath on his plan on the following scale. A is the top, B the bottom of the bath, and the lines show the strata of temperature:—

A

100 ————————
96 ————————
94 –
90 –
85 –

B

And even supposing "lukewarm" to mean a temperature of 95, then the heat of the bath would be as shewn at C, whereas if it was properly constructed it should be as at D:—

	100	92	
	98	94	
C	91	96	D
	90	98	
	95	100	

And this should be produced by steam *only*, as the effects of steam and water on the system at the same temperatures are different, the former acting as a stimulant after the superinducing cause ceases to exist, the latter only while the parts are immersed.

I am Sir, yours,

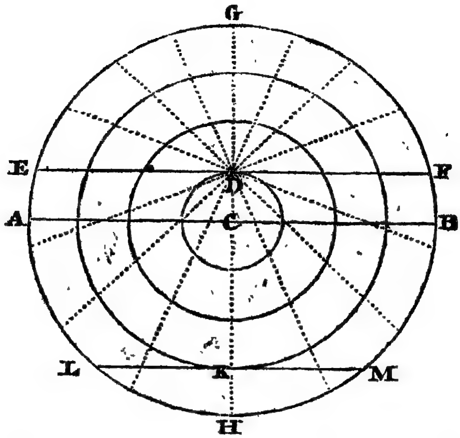
39, Chiswell-street. AN OLD SAILOR.

MOTION OF A CANNON BALL TOWARDS THE CENTRE OF THE EARTH.

To the Editor of the Mechanics' Register.

Sir—Seeing in your last Number, page 141,* a correction of the statement of the doubts of T. S. respecting the motion of the cannon ball, I beg leave to submit this amended reply, in order more pointedly to remove those doubts.

I will, with your permission, illustrate my ideas, by a diagram similar to that of T. S.



I perfectly coincide with your correspondent, in believing that the ball on its arrival at the centre C, would be equally attracted on all sides; and also, that it would be attracted on all sides in the manner represented by the lines from the point D to the circumference, on its arrival at that point; but it would not be attracted upwards by a force equal to three, and downward by a force equal to five, but by two forces, bearing the same proportion to each other, as the mass above the line E F, bears to the mass below that line, E F being perpendicular to the line of the ball's direction G H; again, since gravity is an accelerating force, the motion of the ball between G and the centre C must be accelerated, for, in every situation of the ball above the centre, a greater attraction is acting on it to draw it downwards, than is acting on it to draw it upwards, because the lower mass is greater than the upper, and this greater attraction to draw it downwards continually acting, until its arrival at the centre, the motion must be accelerated, until it arrives at that point where its momentum consequently, is at its maximum; this momentum will carry it a certain distance below the centre, suppose to K, during which its motion will be retarded and ultimately destroyed by the attraction of the greater mass above every situation of the ball between the points C and K, at which latter point it will begin to return, because of the greater attraction of the mass above the line L M, thereby acquiring momentum to carry it again beyond the centre; thus the vibration of the cannon ball would be effected, till it become stationary at the centre, agreeable to the hypothesis advanced by Mr. Wallis in his able and instructive lecture.

Hoping this explanation will not fail to remove the doubts of T. S. and that I am not encroaching too much on your excellent work, I remain Sir,

Yours respectfully,

June 25, 1825. H——Y P——E.

To the Editor of the Mechanics Register.

Sir—Not being a mathematician I am unable to give a demonstration of the cannon ball question, but it does appear to me that Mr. Wallis is right—for admitting the gradual diminution of attraction, and its entire cessation on the ball arriving at the centre, still as up to that moment there will have been a power urging it forward, I do not think its momentum would be at once destroyed, but that it would be carried beyond the centre, in the same way as a carriage, by the momentum acquired in running down one inclined plane, will run up another; for here gravity will be wholly against it when it arrives at the bottom.

A Member of the L. M. Institution.

TO PREVENT THE PREJUDICIAL EFFECT OF DRY GRINDING NEEDLES.

To the Editor of the Mechanics' Register.

Sir—It is much to be lamented that a trade which is essentially necessary should be attended with an injurious effect on the constitution. Such it seems is the case with the needle grinders; for the small particles of steel which are thrown into the air, are unavoidably received into the lungs, and occasion asthma, consumption, and

other maladies. Now it strikes me that if a powerful magnet were placed near the needle, it would attract the atoms of steel, so as to prevent their being inhaled into the lungs, and would consequently obviate the fatal diseases that arise from the dry grinding of steel.—I am, Sir,

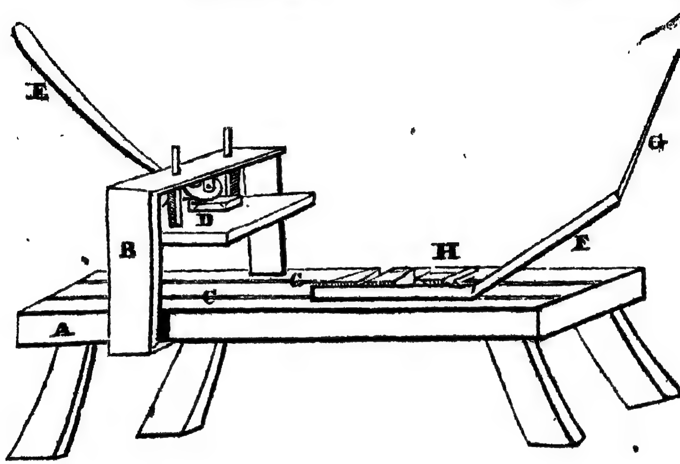
Your obedient servant,
DAVID THOMAS.

SIMPLE LEVER PRESS.

To the Editor of the Mechanics' Register.

Sir—I beg to transmit to you the accompanying drawing and description of a simple lever press, which is much at your service, should you think fit to insert it in the Mechanics' Register.—Yours, &c.

TYRO MECHANICUS.



A, a strong wooden frame, solid, and well strengthened about the part B with iron.

C C, two iron rods to keep the form of types, &c. in its place while sliding. The flat board or stone on which the form is placed rests on the rods.

D, a flat board or iron, called the *platten*, supported by two spiral wires, and having an upright rod on each side, passing through the top beam, to make it rise and fall evenly.

E, the working lever, which by being pulled down gives the pressure; its end is made in this form, therefore as it is pulled down, the radius becomes longer and there not being room for the increased radius, the platten is pushed down to make room. The power increases in proportion as the length of the lever exceeds the radius.

F, the tympan. G, the frisket.

H, the types.

LIGHTNING CONDUCTORS.

To the Editor of the Mechanics' Register.

Sir—At page 126 of the first volume of your Register is a letter on lightning Conductors, pretending to confirm by facts, certain prognostications of Lieut. GREEN, to their disadvantage.

First—Lieut. Green is said to have foretold "that Charles' Church, at Plymouth, owing to its having a conductor, would one day be knocked down about the ears of those who might be in it;" this the writer appears to infer has been confirmed by the event.

Now as to the fact:—the above-named church was struck by lightning, but the steeple, tower, and church remained *unhurt;* not even a pane of glass was broken, though the electric shock damaged the conductor,* ripped up the ground, and did

* It may not be amiss to state, that this church has for many years been furnished with a conductor, which consisted of brass wire;—it was led down inside the steeple, and from thence out through one of the windows in the tower below, its termination being in the shed above named. From the length of time this conductor had been exposed to the action of the atmosphere, it had assumed a black appearance, and had been very loose at the points where the lengths of wire were united; moreover the

some mischief to a little temporary shed at its foot. A new conductor has been since applied, not only on this tower, but in various other places here, with all the increased confidence which such a circumstance could not fail to inspire.

On the other hand, Shaugh Church in our vicinity, which had *no conductor*, was some time since struck by lightning, *and both tower and church shattered.*

Secondly—Lieut. Green is quoted, "that the whole of our fleet at Plymouth and our naval arsenals, with the lives of all on board the ships are tottering on the brink of destruction, as a cloud fully charged with the electric fluid may destroy them all," (that is to say in consequence of their having lightning conductors.) Now as to *this* fact, a thunder cloud about two years since did actually pass down the harbour here over the mast-heads of the fleet, and the only ship damaged, was the Milford,* which ship, and it is not a little remarkable, was the *only* one (over which the electrical cloud passed) that *had* NOT *a conductor!*

This I think but fair to state for the information of Mr. Lloyd and your other readers, because it is of importance that facts should be correctly known. If any one should wish for a further explanation of these circumstances, I will readily afford it.—I remain, Sir,

Your very obedient servant,
Plymouth, June 21. WM. SNOW HARRIS.

conductor was of very small dimensions. That such a conductor should be disjointed and bent by the passage of a powerful electrical discharge, is not at all singular. This circumstance proves nothing against the *use* of conductors, but a great deal against the *abuse* of them, that is to say, against their misapplication.

* This ship was at that time under the care of Lieut. Allen, R. N. and I beg leave to refer to him as having been on board when the ship was struck.

ON THE DIPPING NEEDLE,
In reply to Mr. POPE's Letter, page 125.

Sir—Upon perusing in your valuable Register Mr. Pope's remarks on my communication respecting the dip of the magnetic needle, I could not but admire the candour and disinterestedness of his observations, though it appears to me that his opinions are palpably erroneous. His first observation on the subject is, that the *south* pole of the globe does not attract the *south* pole of the needle, because they are of the same name, and poles of the same name it is well known *repel each other*. May I here ask, how it happens that the *north* pole of the globe attracts the *north* pole of the needle, which is of the same name, and repels the *south* pole, which is of a different name? I can easily perceive that Mr. Pope makes this remark because the south poles of two magnets repel each other, and likewise the north poles; but it appears to me that he has not considered that the names of poles has been given from their *directive position;* that is, the north pole is so called because it points to the *north*, and the south in consequence of its pointing to the south Had the poles of the magnet been named on account of their similar virtue to that of the poles of the globe, their names would have been quite the reverse, so that your correspondent's good sense will enable him to see his mistake in this particular.

His next argument is, "that poles do not counteract each other, but each pole has two opposite properties, so that while it draws down by attraction one end of the needle, it draws up the other by repulsion, and both conspire to make the dip perfect with the magnetic meridian!" Here is an extreme of self-contradiction; had Mr. Pope kept to his first assertion, he would have been more consistent, although erring; but here he asserts, that each pole has two opposite properties; that is, both to *attract* and to *repel*. If this be the case, the needle is neutralized, so as to have *no dip*, unless one of the poles has a greater influence than the other, in which case a dip would be produced, which would be the difference in the counteraction. But how wonderful that your correspondent, after asserting that each pole has a double property, should deprive one of the poles of this double property, and leave the other to attract one pole of the needle and repel the opposite pole, and by so doing find out the perfect dip. It is also very strange that he should so positively assert, that the poles do not *counteract* each other, as it is generally known by experiment that there is a *counteraction*. For instance, when the *south* pole of a magnet is held above the *north* pole of the needle, the latter is drawn towards the magnet; and if the *north* pole of another magnet is held above the *south* pole of the needle, then a counteraction takes place, and the needle will incline to the nearest magnet, because of its greater influence. What can be more decisive on the subject? Besides, when the needle is in the northern latitudes, the dip is towards the *north* pole, but when it is at the southern latitude, the dip is towards the *south* pole. It is probable that your correspondent has entered

too deeply into the salt of Mars, which on being fired, might confuse his ideas, which has been the case with many philosophers.

I remain, Sir,

Your very humble sarvant,

David Thomas.

P. S. As a mistaken opinion in a person of Mr. Pope's celebrity may lead to erroneous ideas respecting the properties of the needle, so important in navigation, I hope you will have no objection to insert my reply.

REV. MR. COBBIN'S PORTABLE FIRE ESCAPE.

We have received a letter from Mr. Cobbin, the ingenious inventor of the Portable Fire Escape, of which an engraving, accompanied with a minute description of its construction and operation was given in our first Volume, page 34. In this communication Mr. Cobbin states that he submitted his invention to the Society of Arts, and claimed a participation in the rewards bestowed by that institution for discoveries of public utility, but that his claim was rejected, in consequence of the publicity given to his Fire Escape in the Mechanics' Register.

From the kind and disinterested manner in which Mr. Cobbin obliged us with the drawing and description of his machine, we cannot but sincerely regret that the communication of his invention to the public through the medium of our pages, should have prevented the recognition of his claim to remuneration by the Society of Arts. But while we acknowledge the merits of his invention, and our own obligation to his kindness, we cannot acquiesce in his animadversions upon the conduct of that valuable institution, in adopting the regulation by which Mr. Cobbin's interests may have been affected. Upon a superficial view of the subject, we might possibly be disposed to think the regulation unnecessary, but without knowing the grounds upon which it has been passed, we would not hastily censure a law, which the experience of the society may have induced its members to consider judicious. It is well known that the Transactions of the Society are published periodically, and that no expense is spared to illustrate, by handsome engravings, the various inventions for which the premiums have been awarded; and it is not surprising that the subscribers should wish that their own publication should be the first to make known to the world the discoveries of the individuals whose claims have been successful. We are far from asserting that this is a sufficient reason for withholding a reward from the author of a beneficial invention, particularly if he has previously published it, as in the case of Mr. Cobbin, without being aware of the existence of such a regulation; but we presume that other reasons, with which we are unacquainted, must have influenced the society in its adoption, or in its application to the claim of Mr. Cobbin; and we are confirmed in this opinion by the decision of the institution in a recent instance; for the Silver Medal and Fifty Guineas were presented to Mr. John Roberts for his admirable Hood and Mouthpiece, though his invention had been repeatedly adverted to in the Mechanics' Register, and an illustrative engraving, with a full description of the apparatus, had been published in our pages previous to the society's decision on Mr. Roberts's application.—Ed.

REPEAL OF THE COMBINATION LAWS.

The repeal of the Combination Laws seems to have given rise to two feelings; an ebullition of licentious liberty by the workmen, and a grave apprehension of danger by the masters; both of which in a national view are unimportant. The first is generally the immediate, but temporary consequence of the removal of restraint; and cool calculation and hungry stomachs cannot fail to restore the mechanics to work, but it no more requires a law to force labour, than to force corn into the market: and whether the farmer or the carpenter stand out for his price, I confess I perceive but little difference. If the manufacturer cannot afford to pay his workmen their minimum, let him stop his manufactures, but if such wages still leave a great profit let him share it with them.

Exorbitant wages or profit can never long be monopolised; the former will induce more mechanics, and the latter fresh merchants to engage in the particular trade which affords it, and labour is thus secured

at a fair remunerating wages and profit; and it appears to me both ridiculous and unjust to legislate against the temporary rise of wages (supposing combination obtains it), when such brings with it its own remedy. Trade flourishes best unfettered by acts of parliament, and it is as unjust to compel the mechanic to make a kettle for sevenpence, as it would be to compel his master to sell it when made at a shilling. Why should not cotton spinners combine to fix their wages at five shillings a day, as well as lawyers to fix their fee at six shillings and eightpence, or brokers their commission at a half per cent? When the silk mercers fix for a season the price of a new-pattern shawl at five guineas, we do not complain, although the next summer they are vended for thirty shillings; and it is too much to tell mechanics they shall not combine for a rise of wages *while we permit masters to combine in resisting it*. The fair enquiry is not what a mechanic can exist on, but what is his labour worth. The price of wheat is regulated by what it will fetch, and not by the cost of raising it, and it is equally absurd to endeavour to prevent the combination of the mechanics, as it would be to prevent farmers from agreeing to pot their spring butter, rather than to sell it at 7½d. a pound. R***.

ELECTRICAL PHENOMENON.

Sir—I have extracted the following account of an electrical phenomenon from the New Monthly Magazine; the insertion of it in your valuable and widely disseminated work, may possibly be the means of preventing some of your readers from being placed in the same striking, but not very pleasing situation.

I remain, Sir,

Yours obediently, E. X.

" A new feather bed was put into a cold and damp room, and a person incautiously went to sleep in it, without the precaution of having had a fire put in the room during the day, to remove the dampness. Scarcely had he been ten minutes in bed, when he fancied he saw light issuing from his eyes; for this supposition he had the best possible reason, as from the situation of the room, there was not the least cranny or opening at which light could be supposed to enter, the doors and windows being fastened. He paid no attention to this circumstance at first, thinking it was the effect of mere imagination; he had like, however, to have paid dear for his temerity.

" Feeling rather chilly owing to the state of the room, he put his head under the bed-clothes to increase his warmth; he had not continued longer than five minutes in this situation, when on removing his head from under them, he suddenly felt, as it were, a severe blow on the shoulders, neck, and head, and the pain seemed to run along the spine, at the same moment a blue flame flashed from his eyes, and a permanent circle of lambent light appeared to irradiate their sockets.

" Perfectly certain that no person was in the room but himself, he sat up in the bed for a moment to reflect on the cause, as the light still continued to flow from his eyes; he immediately recollected that the bed and pillows consisted of new feathers, and that they might be in a highly electric state, and that the shock he had received must have proceeded from them.

" No sooner had he formed this conjecture, but he leaped on the floor, and found it verified; and before five minutes had passed, it was totally gone. Having no desire to repeat the experiment that night, he went to another room for the remainder of the evening.

" Some nights afterwards when a fire had been introduced into the room where the phenomenon took place, and matters had been comfortably arranged, he went to bed as before, and surprising to relate, he experienced exactly the same results. He had now no doubt of the facts, and he was convinced that the shocks he had received were owing to the electric state of the feathers in the bed, as they were precisely similar to those he remembered having received from an electrical machine, or a Leyden jar."

FAMILIAR LESSONS ON GEOLOGY.

(*Concluded from page* 138.)

Primitive schistos, or *clay slate*, belongs to it, which often presents itself alternating with granite; it abounds with veins filled with quartz, fluor, &c, also many and various metallic substances. Clay slate is of a dull dark colour, bluish black, it is earthy and splits freely, absorbs moisture and cannot be mistaken after being once examined

Primitive porphyry belongs to this order; it is of a red brown, with angular patches of light felspar, or dull green, and migrates into lighter or darker shades; that called Egyptian porphyry is the hardest, and may assist the beginner in discriminating other varieties.

Green stones from containing a great portion of felspar, belong to this order, and though they are so intermixed with hornblende, which is frequently in minute par

ticles, yet the felspar may be known by its lustre and flaky appearance.

Varieties of *basalt, trap, grau-wacce, toad stones, shale*, &c. are ranked in this order.

These substances when decomposed (to which many varieties are so subject) form clay. The felspars produce the finest, which is used to make China and the best earthenware. Clay slate, shale and the more earthy varieties, when decomposed form common potter's clay, which is used for coarse earthenware, or for bricks. The beginner may discriminate common argillaceous substances, merely by wetting or breathing on them, when they give out an earthy odour.*

After the preceding earths so universally distributed, the magnesian claims our attention: it does not occur in so great a proportion as the others; on the contrary it may be deemed scarce.

Magnesian class. The *serpentines* belong to this order; they occur at the Lizard in Cornwall, in a tract of several miles in extent; another variety is found in Scotland, and it occurs in various other parts. Many of the traps and amygdaloids, contain portions of magnesian earths which may be known by being slippery or greasy to the touch. Mica, talc, and the soap like substances, steatite, and many clays, asbestos, &c. belong to this order.

Hornblende, a substance generally diffused, forms a part in granitic rocks, as *gneiss*, and *sienites*, also in serpentine; it may be known from mica, on being gently struck with the small end of a hammer so as to abrade it, or scrape it with a knife and a dull green powder will be produced; it contains a large portion of iron; it is very abundant in basaltic rocks, trap, amygdaloids, green stones, &c; when in decomposition it is red, ferruginous, and frequently colours clay, particularly if it is associated with decomposed felspar.

Barytes forms so small a portion of the earth's surface, that it rather belongs to the class of fossils, and though by no means scarce in this country, yet it is so limited as not to admit of the most distant comparison with any of the preceding; it is commonly found in veins, does not compose any other formation, and may be known by its great weight; it yields to the knife, and is frequently massive, of an earthy texture, and resembling chalk, it is also crystallized and transparent. It is considered an alkaline earth; its properties are well explained in Parke's Chemical Catechism.

A variety called *carbonate* of *barytes*, is more rare; it has generally a striated and diverging fracture; it is very compact, and, as common barytes, may be known by its great weight.

Strontian is an earth newly discovered; it differs but little from the preceding, but it is not so heavy, and is generally of a sparry texture; often of a very light blue colour, and is then called *celestine*; it occurs fibrous and also of a dull earthy appearance.

Another variety called *carbonate* of *strontias*, is light green, striated; it is often accompanied with earthy barytes; and may be deemed rare.

The chemical properties of these may be seen in Parkes's Catechism, and a more particular description of them in the new descriptive catalogue of minerals.

* Adamantine spar, and what are termed Oriental stones, as the sapphire are chiefly agill.

LONDON UNIVERSITY.

A public meeting was held at the City of London Tavern, on Friday in last week, for the purpose of considering the propriety of forming a Company to establish a University for the Education of the Youth of the Metropolis, intended for commercial or professional pursuits. The Great Room was intensely crowded, and a great number of persons went away without having been able to obtain even standing room. The Right Honourable the Lord Mayor took the Chair.

Mr. Fox, the Secretary of the Committee, appointed to bring the measure forward, read the statement of the plan of the proposed university. The document, at considerable length, described the great necessity for such an institution. It was proposed to call it the City of London University. It was intended to keep it open nine or ten months in the year. The classic and modern languages should be taught there. It should be a college for science, logic, moral philosophy, jurisprudence, medicine, &c. and the government should be vested in a Chancellor, a Vice-Chancellor, and a Council of 21, of whom four should go out each year. The right of appointing these officers should be vested in the shareholders, and every person holding a 100*l*. share, should be entitled to a vote, and every person making a donation of 50*l*. should be entitled to a vote for life. To accomplish the establishment of the proposed university, a sum of 300,000*l*. was to be raised, by means of 3000 shares, of the value of 100*l*. each. No person would be allowed to hold more than ten shares. Every holder of five shares would

be entitled to two votes, and every holder of ten shares to three votes.

John Smith, Esq. M. P. said, that the cause of improvement had, within the last two years, made vast progress, and every class now appeared sensible of the benefits and the necessity of education. From the success which had attended the formation of the LONDON MECHANICS' INSTITUTION, and within a few days past of the New CITY OF LONDON LITERARY INSTITUTION, and the desire which seemed to pervade all classes of the community for the attainment of useful knowledge, some fears had been expressed that, whilst the lower and higher classes were well provided for, the middle and most respectable trading classes of the community would be left without sufficient means of giving their sons a suitable education. This necessity appeared to be exceedingly strong, and a number of gentlemen communicated on the subject, and after some consultation it was discovered, that different bodies of men, actuated by the same views, had begun to take similar steps to form an institution which should afford, at a cheap rate, the advantages of an university education to young men residing in London.

Mr. Brougham, who had been prevented, by his professional avocations, from attending during the early part of the meeting, now came forward amidst loud and continued cheers. He expressed the pleasure he felt at attending such a meeting, which had for its object the diffusion of scientific and literary knowledge, without which riches were but dross; rank but an empty bubble; and power an instrument made, not for the happiness, but the injury of mankind.—(Cheers.) When the progress of the MECHANICS' INSTITUTION was considered, and the progress that was made by the lower classes all over the kingdom estimated, it occurred to his friends that, unless some advance was made by those which were called the superior classes, they would not much longer continue superior. To find their carpenters, their bricklayers, and their shoemakers, with greater knowledge than they possessed themselves, would be a strange and dangerous solecism. The learned gentleman then, at great length, detailed the motives which induced the founders to give up all idea of introducing a "Theological Faculty" into the University. They found they could not agree upon it, and they gave up all idea of introducing it, because each man thought it of too much importance to give up his own view of it, and no one thought because they could not learn theology there, that they could not learn the sciences and the Belles lettres. A man might say "I'll teach my children chemistry, mathematics, and medicine at the London University, but I'll send him to Oxford or Cambridge to have him taught theology." There was the university at Glasgow, for teaching those who were to be brought up to the Scotch Church; and there were schools at Hackney, or elsewhere, for the religious education of the Dissenters. It was from no wish to undervalue its worth that they excluded theology. They thought that those Divine Subjects might be taught without being mixed with human science. He then adverted to another point—that many good and wise people disliked sending their children away from their own roofs, at the dangerous age when the character was forming. It was said that London was a very immoral place; but he for one should prefer sending his son to an immoral place, where he would have him under his own eye, to sending him to a moral place where he would be entirely from under his control. Thus he would prefer sending him to the most immoral place, (London for instance,) to sending him to the most moral of all places (Oxford or Cambridge for instance.) (Laughter.) He then expatiated upon the condition of many commercial and other youths in the City of London, who were compelled to learn their higher avocations during the very time when, in order to obtain a collegiate education, they must be at the university. He said that no tests would be required in entering the projected university; that tests were in fact no better than traps for sincerity. Mr. Brougham, after a few more observations, ended, by declaring that the City of London would, by this means, rise above the various prejudices; and he might say with Goldsmith—

"As some tall cliff that lifts its awful form,
Swells from the vale, and midway leaves the storm,
Though round its breast the rolling clouds are spread,
Eternal sunshine settles on his head."

(Loud cheering.)

Dr. Birkbeck, Sir James Mackintosh, Mr. Denman, Mr. Abercrombie, Lord John Russell, &c. &c. also spoke in favour of the plan, and a series of resolutions was adopted for the foundation of an university, to be called the "LONDON UNIVERSITY."

LONDON UNIVERSITY.

To the Editor of the Mechanics' Register.

Sir—I have with the utmost pleasure witnessed the very favorable reception which Mr. BROUGHAM'S bill for establishing a LONDON COLLEGE has met with,

both in and out of the House of Commons. Much as I approve of the principle, yet I think the plan not extensive enough; more particularly as I am given to understand, it is intended to confine the project to day pupils. Now it appears to me, that it would be more economical to the parents of the youth, were they also to be boarded, and at the same time it will (as must be well known) give the children a much better opportunity of perfecting their studies; as well as keep them from any opportunity of following bad company, to which all are liable. That the maintenance of boys can be accomplished on much lower terms for large numbers, such as I trust this college will soon contain, will I think be readily credited, especially if they have any opportunity of witnessing plain, frugal, and healthy meals provided at Christ's Hospital and other such institutions. However to *satisfy* myself, I made a rough calculation of the probable expense of 100 boys for one week; the result is as follows:—

	£.	s.	
700lb. of bread at 2d. . . .	5	16	
350lb. of butcher's meat at 6d.	8	15	
30lb. of butter at 10d. .	1		
87½ gallons of milk at 1½d.			
I allow for vegetables .			
Also for flour, &c. &c. . . .	3	1	3
Which makes the cost of provisions per week . . .	25	0	0
Or per annum	1,300	0	0
Now for clothes I calculate that £7 will furnish each boy sufficient for twelve months	700	0	0
	£2,000	0	0
And to make the charge no more than £25 for one child, will leave towards paying the teachers, books, and other expenses, per year	500	0	0

I am particularly partial to boys being clothed alike, as it prevents that spirit of vanity so common with them, should any by the fondness or caprice of the parents be provided with finer than the others. I hope Sir, you will excuse my troubling you with this statement, but I must assure you, it was principally because I have not yet seen that valuable bill noticed in your widely circulated work, which is in general so forward with any subject likely to promote useful knowledge.—I am, Sir,

Your humble servant,

Kingsland, June 14. EDMUND WALLER.

PEACE ENGINE.

☞A gentleman of Ohio has published an account of some extraordinary inventions made by him, one of which he denominates a "Peace Engine," because it is much more destructive than Mr. Perkins's steam cannon! "One single discharge of my peace engine," he remarks, "may destroy 1000 men! and be as quickly repeated as the discharge of a pistol." There may be peace when every body's dead.—(*Amer. Paper*).

RECEIPT FOR BLACKING.

To the Editor of the Mechanics' Register.

Sir—I desire to convey through the medium of the London Mechanics' Register, a receipt for making the best and cheapest boot and shoe blacking at present known of, I have made and used it for the last 25 years, and although there is oil of vitriol in it, the corrosive quality of the acid is entirely neutralized by the other ingredients. Some 16 years ago, I purchased a bottle of blacking made by a celebrated manufacturer, for the sole purpose of trying his against mine, and I found my own the best.

I would recommend the manufacture and sale of my blacking to any worthy member of the London Mechanics' Institution who may be supporting a family upon a small weekly pittance: before such a person I would make three pints in ten minutes, which would be all the instruction he would ever require:—

First, A table-spoonful of sweet oil,
Second, A quarter of a pound of ivory black,
Third, A quarter of a pound of treacle,
Fourth, A pint of table beer.*
Fifth, Two ounces of oil of vitriol.
These five articles to be all of the best quality.

Put the Florence oil into a wash hand basin, then add a little of the ivory black and beat them well together with the back of a spoon, keep adding the black till it is all well mixed with the oil, then add the treacle in the same manner till all are well mixed; afterwards add the table beer (a little at first) till all are well mixed, and lastly pour in the oil of vitriol by degrees, stirring the compound at the same time; put the blacking in a bottle, cork it up the next day; it will now be fit for use, and will keep for many years. ALEX. MORISON.

5, Duke's-row, A Member.
Tavistock-square.

N. B. This blacking has no disagreeable smell.

* Half-a-pint more may be added for sale.

SPITALFIELDS MECHANICS' INSSITUTION.

The members of this institution held their first quarterly general meeting on Wednesday the 29th ult. upon which occasion the chair was taken by WM. BELL, Esq. one of the Vice-presidents, supported by Dr. Southwood Smith and R. Graham, Esq. Vice-presidents, and James Stranger, Esq. Treasurer. The meeting was well attended, and the proceedings of the evening were conducted with the greatest harmony and regularity.

Mr. DOWNES, the Secretary, read the report of the committee, which commenced by adverting to the advantages which had resulted from the appointment of sub-committees, for the management of the various departments of the society's affairs, and proceeded to detail the operations of the committee during the last quarter. From the financial statement it appeared that the receipts of the quarter, in members' subscriptions, donations, &c. amounted to £198 : 17s.;—the disbursements to £284 : 17s. : 0½d.;—and the balance in the hands of the bankers to £581 : 16s. : 8d. Among the donations announced were Messrs. Calvert and Co. 10*l.* Messrs. Barclay and Co. 10*l.* a Friend, per Mr. Gibson, 20*l.* Messrs Gendoffe, 10*l.* Messrs. Springfield and Co. 10*l.* with a number of smaller donations. About 100 volumes of books, comprehending many valuable scientific works, had also been presented to the library,

After detailing the proceedings of the sub-committees for the lectures, apparatus, library, &c. the report contained the following appropriate remarks respecting the elementary schools, &c.

"The last subject connected with the plan of the institution, which your committee have to notice, is that of elementary schools or classes; and to this they would wish particularly to call your attention. Great improvements have lately been made in the general system of instruction, and though it is not possible that a person should become acquainted with any branch of knowledge without patience and perseverance, it is very possible that the method by which he is to obtain his object, may be rendered easy and inviting. By proceeding in his subject on a regular system, and by the mutual assistance of those who are in the same course with himself, he may make much greater advances than by his own unassisted exertions, however sincere and constant.

The method of instruction by public lectures possesses many advantages; and there are some sciences which could not be understood without the assistance of experiment. But there are also very many and very useful branches of learning, which may be pursued with more benefit in a more private manner; indeed there are some which it would be impossible for a public lecturer to render intelligible to his auditors, such as languages, mathematics, the art of design, &c. For the acquirement of these it is, that private classes are found to be of essential benefit. The conversational form which may be introduced; the time that is afforded for reflection; the help that one member of a class gives to another; and above all the assistance of the teacher, render this plan particularly adapted to such an institution as ours.

The committee have thought it advisable in the outset, to establish classes for the French language, for arithmetic, for mathematics, and for English grammar. Mr. Downes has kindly undertaken the management of the mathematical class gratuitously; and Mr. Beck with the same liberality, the class for English grammar. Mr Black is engaged to teach the French language: his system has proved very successful at the London Mechanics' Institution, where he has three classes under his management, each class consisting of 58 members. It is scarcely necessary to state, that the constant intercourse now subsisting between the two countries of France and England, would be alone sufficient to make the acquisition of this language desirable. The committee look confidently to the active co-operation of the members of this department of their duties, and hope that the formation of the above-named classes will be followed by that of others on equally important subjects.

Before concluding their report, your committee wish to suggest to you the propriety of an alteration in one of the rules of the institution. The 71st rule provides, that half of the committee shall be changed at the next general quarterly meeting, and it also provides that the 15 names that stand at the bottom of the list, shall be persons that shall go out of office. This last provision they submit should be changed; for among these 15 names, are found members of the committee who are most constant in their attendance, and from whom the institution has received very efficient and important assistance. The rule they would recommend for adoption at the first election is, that 15 of your committee who have given the least attendance should be selected, and that these shall not continue in office; and should the attendance of any part of these 15 persons be equal, that they shall decide by lot who shall remain and

who shall go out of office. This regulation would be acted upon only on the first election, as in future elections the half of the committee who are to go out of office, will have served the full term of 12 months, beyond which term it is not advisable that they should continue in the management, to the exclusion of other members of the institution."

The report concluded by recommending the members to use their most strenuous exertions to promote the interests of the institution, and expressed the strongest confidence of the committee in its ultimate success.

The report was received with unanimous approbation, and the suggestion of the committee, that the fifteen who had given the least attendance should vacate their seats at the ensuing election, was immediately agreed to; as was a resolution for allowing each member one free admission on paying his quarterly subscription, or introducing a new member.

In the course of the evening Mr. Black gave a general outline of his system of teaching the French language, and announced his intention of elucidating it more fully on the following Wednesday.

The cordial thanks of the meeting were voted to the committee for their exertions, and to Thos. Gibson, Esq. the President of the Institution, for the lively interest he has taken in its welfare, and for his indefatigable efforts to promote its prosperity.

Mr. Gibson, Jun. in the unavoidable absence of his father, acknowledged the honor in a neat speech; and after passing a vote of thanks to the chairman for his able superintendence of the business of the evening, the meeting adjourned.

LEEDS MECHANICS' INSTITUTION.

The First General Meeting of this Institution was recently held at the Court House, upon which occasion the chair was taken by B. Gott, Esq. The meeting was numerously attended, and consisted principally of operative mechanics, besides whom were many gentlemen of great respectability.

Mr. Todd, the Secretary, read the report, which gave a historical sketch of the proceedings of the Institution, and stated the numbers of the students in the different classes, with the progress they made in their studies. These statements were highly satisfactory: the mathematical and arithmetical class contained fifty-six members: several excellent specimens were shown of the productions of the architectural and mechanical drawing class; and it was stated that the chemical class had expended £20 of their own money in books and apparatus. The present number of members is 202; that of the subscribers 362; making a total of 564.

	£	s.	d.
Amount of subscriptions	£527	10	0
Ditto donations (including £250 by Mr. Gott) -	430	0	0
	957	10	0
Amount of expenditure -	460	12	10
Balance in the Treasurer's hand - - - - - - -	469	17	2

The report went on to state, that there were in the library 191 works, comprising 445 volumes; besides 47 volumes in the hands of the binders. During eleven weeks, 1,515 volumes have been distributed among the members and subscribers. The report acknowledged the handsome donation of Mr. Gott, as also those of Mr. Marshall, Col. Smithson of Heath, and several other gentlemen. It also announced the generous offer of Mr. R. Dalton, to lecture gratuitously in the month of July, on mechanics, hydraulics, hydrostatics, and on steam engines; and concluded by expressing the satisfaction of the committee that their institution was gradually advancing in the estimation of the working classes.

Mr. Luccock, one of the Vice-presidents, expressed the obligations of the members to the Philosophical Society, for the use of their hall, and submitted a series of resolutions, suggested by the committee, for the erection of a building suited to the purposes of the institution. The resolutions were carried by acclamation, and instructions given to the committee to proceed accordingly.

After an excellent speech from Mr. Baines, Jun. in which he congratulated the meeting on the numerous Mechanics' Institutions now in operation in Yorkshire and Lancashire, a ballot took place for the election of new officers, and the meeting then adjourned.

BRISTOL MECHANICS' INSTITUTION.

An institution of this nature was formed at a public meeting lately held in Bristol, Richard Bright, Esq. in the chair. Several excellent speeches advocating the institution were made by the Revs. W. D. Conybeare, Dr. Carpenter, and J. Rowe, Dr. Kentish, and several other gentlemen and mechanics. It was resolved that the institution should have a library, scientific apparatus, models, lectures, and evening schools, that the annual subscription should be 10s. and that two-thirds of the commit-

tee of management should be taken from the working classes.

BATH MECHANICS' INSTITUTION.

We have at length the pleasure of recording the actual establishment of a Mechanics Institution in this city. On Monday evening, the 13th of June, a second meeting of masters, journeymen, and apprentices of various professions and trades took place at the Auction Room, No. 21, West-gate-street, at which the regulations, adopted by the Committee for the conduct of the establishment, were read and unanimously agreed to, and nearly one hundred individuals entered their names as members. The regulations make all the members who gain their livelihood by any employment, joint proprietors; and gentlemen of independent fortunes, honorary members; but these are little more than merely nominal distinctions, each will be entitled to an equal participation of the advantages, the only difference will be, that proprietors alone will be suffered to be elected on the Committee.—Though it is thus intended to keep the management of the Institution in the hands of those who must feel the greatest interest in its welfare, the propositions of gentlemen who have talents and leisure to suggest improvements, will always be received with gratitude, and cannot fail of having their due influence.

Without being sanguine about the success of this establishment, there is one effect we may calculate on with the utmost certainty, that is, a proof whether the numerous and opulent inhabitants of Bath possess the same generous feelings which have prompted those of other places, to come forward in behalf of that class which stand in need of their assistance; or whether they are under the influence of narrow minded prejudices, and those aristocratical principles which oppose the attainment of knowledge by any below the sphere of gentility. For our own parts, without waiting until it is brought to the test, as it shortly will be, we are, from the general liberality evinced in this city, strongly disposed to believe that the establishment will meet with the most generous support; we think that the germ is deposited in a fruitful soil, where the tree will spread its branches extensive and luxuriant; however, should our expectations not be realized, let us impress upon those who have already come forward in the cause of knowledge the necessity of being nothing daunted: admitting the possibility that, in this refined and wealthy city, the Institution should fail to meet that liberal support which those of other towns have so happily experienced, the present members can of themselves effect much good, though their progress will not be so rapid. They must, of course, well understand, that the property once possessed remains; its benefits may be conferred on all, yet no diminution follow, but, on the contrary, every year will produce an augmentation, and its advantages must ultimately become numerous and important. *Bath Journal.*

QUERIES.

No. 43.—BLACK LEAD PENCILS.

Is it possible to combine the powder of black lead (plumbago) into a substance that will answer *every purpose* for making the best black lead pencils? (I am aware that black lead melted with antimony is useful, but this will not answer) should any of your numerous readers be able to show how this can be effected, it would have the effect of lowering the price of an useful article, that Keswick's neighbourhood holds in monopoly.

ALEX. MORISON,
A Member.

No. 44.

What is the best and most approved method of making good and wholesome *ginger beer* with the greatest expedition.

JUNIUS.

No. 45.

The eye being placed at the end of a walk bounded by two rows of trees planted in parallel lines, sees them not parallel, but always inclining to each other toward the farther extremity. In what lines should the trees be disposed to correct this effect of the perspective, and to make the rows appear parallel? R. YELLOW.

Kilburn, Yorkshire.

No. 46.

If two parts of dry sal ammoniac in coarse powder are added to one part of dry salt of tartar, and put into a clean phial, on shaking the two salts together, you will obtain a very useful pungent smelling bottle.

QUERY.—As neither of these ingredients had any smell before they were mixed, whence arises that scent which may immediately be perceived on their being united.

Kilburn, Yorkshire. R. YELLOW.

No. 47.

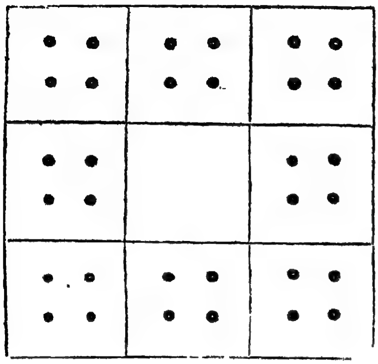
How is black lead prepared for pencils, and how put into the wood so evenly?

TYRO MECHANICUS.

No. 48.

Sir,—Perhaps some of your readers may

be able to solve the query contained in the following diagram. In the square there are twelve dots every way. I am required to remove eight of the dots, and then to add four; how am I to accomplish this so as still to have twelve every way as before? Your insertion of this will oblige your constant reader, HENRICUS.



ANSWERS TO QUERIES.

QUERY, No. 51, Page 142.
COMMUNICATION OF POLARITY TO BARS OF STEEL

Woolwich, June 28th, 1825.

Sir—It gives me much pleasure to have this opportunity of answering the query of your correspondent B, inserted in your truly useful and valuable Register, as I have frequently mentioned the fact which your correspondent is so desirous of knowing, and which I thought was more generally known than it appears to be. I have now, and have had in my possession for several years, two bars, one of which has at each end a *north*, and the other at each end a *south pole*, with the opposite power in the centre of each bar, and I beg leave to assure your correspondent that there is not the least difficulty in producing this effect.

It is a well known fact, that in order to magnetise a piece of steel, whether in the form of a simple bar or in that of a horse-shoe, it is necessary that we pay attention to the manner of touching it with the magnet; for instance, if we wish to magnetise a bar of steel, we must first decide which end of the bar is to possess *north* polarity; this being done, we must next be careful to rub that end with the *opposite pole* of another magnet. Now this being the case, it will immediately be seen, that if the whole length of the bar is touched with the *north* or *south* pole of a horse-shoe or bar magnet, the bar so touched will possess poles at each extremity of an opposite name to that with which it was rubbed.

But the most simple way of shewing this fact is to bend a piece of iron wire in the form of a staple; then touch the middle of the staple with only one of the poles of a magnet, without moving it backwards or forwards;—the place where the magnet touches the wire will be one pole, and the two ends will exhibit the opposite power by bringing them near a suspended magnet.

Bars, however, may be made with several poles. To produce this effect, it is only necessary to place magnets at those parts where the poles are intended to be: the poles to be of a contrary name to those required, and if a south pole is fixed on one part, the two next places must have north poles set against them; we must then consider each piece between the supporters as a separate magnet, and touch it accordingly.

In stating the foregoing facts, I wish it to be understood that I lay no claim to them as discoveries of mine; but merely state them as facts, which as I before observed, are well known to most magnetists, but which appear to be not generally known. In conclusion I have only to observe, that if your correspondent is desirous of knowing more on this subject, I shall feel most happy in having an opportunity of forwarding to him the information required.

I am, Sir, your obedient servant,
JAMES MARSH.

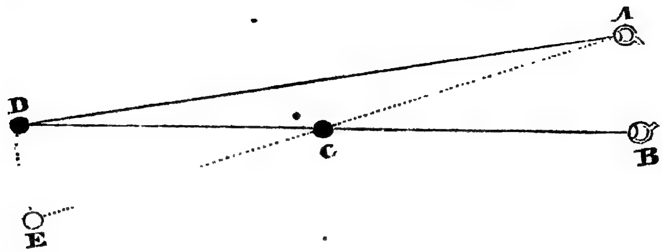
QUERY, No 34, page 79.
OPTICAL QUESTION.

Sir—In answer to the optical question (No. 34), allow me to state what I consider to be an explanation of the phenomenon therein-mentioned.

To observe the effect referred to by your correspondent, I fixed a piece of wire perpendicularly in a horizontal bar of wood; at a short distance from the wire I placed a pencil as a mark of comparison, I then looked along the bar, and observed, that when my attention was directed chiefly to the nearer object, I saw two images of the more distant; but when my attention was principally fixed on the more distant, I saw two images of the nearer object, and the more distant one occupied the centre of the space between them. While the eyes were in this position, if I shut the right eye, the image on my left disappeared, and if I shut the left eye, the image on my right disappeared; the other in each case preserving

its original apparent distance from the central object.

The following diagram will further illustrate and explain this:—



Let A represent the right eye, B the left, C the object, and D the point of comparison; then if the eyes be directed towards the point D, it is manifest that the lines A D and B D will meet and form an angle at the point D, and if the eyes be directed towards the point C, the lines A C and B C will meet, forming an angle at that point also, and in each case the image will be single and distinct.

Now since we cannot simultaneously direct the optic axis to two points situated at different distances from our eyes, we must, in order to compare the direction of the two objects, refer the object C to the plane of the point D, by which means two images of C will be formed, one at D and the other at E, and the magnitude of the images as well as their distance from each other will be directly proportionate to the distance C D, and inversely proportionate to B C. With these premises the following explanation of the proposed question will, I hope, be satisfactory.

By a reference to the diagram, it will be perceived that the object C and the point D are in a right line with the eye, and since this right line is the optic axis of the eye B, the image at D will appear more distinct than that at E, which is not in either of the optic axes; hence in our comparisons we attend only to the image at D, and entirely neglect that at E. Now since the image of the object C already appears in the optic axis of the left eye at D, it follows, that by shutting the right eye no change of direction will be observed; but if the left eye be shut, the image at E, which was before unnoticed, will be distinctly seen by the right eye, and its direction will be as much to the left of the true place of the object, as the image at D was to the right of that point.—I am, Sir,

Yours respectfully, S. P.

P. S. If when C is placed as represented in the diagram, it will slowly move towards the right hand till it again appears to coincide with D, appearances directly contrary to those mentioned by your correspondent will be seen.

Volume 1, page 287.

MR. HOLLANDS' MIXTURE FOR REMOVING SPOTS OF GREASE, &c.

This method is, I fear, not at all to be relied on. The lemon which he recommends to be added, can have no other effect than that of neutralizing a portion of the potash, forming acetate of potash. Now if the acetate of potash is to remove the spots, then, to give it proper effect, lemon ought to be added until the potash is all saturated. To use together an acid and an alkali, not depending on a neutral salt to effect your purpose, is most unscientific. Mr. Hollands culls most extensively, and is doubtless an excellent correspondent. But this receipt, he must allow me to say, has been put together by one altogether unacquainted with chemistry.

A strong solution of the alkali alone, without injuring the cloth, will serve excellently to remove grease or oil spots, but if "pitch," or any thing resinous has to be removed, it will be found useless. Spirits of turpentine is then the best thing that can be used. F. C.

Volume 1, page 287.

PRINTERS' INK.

Oil fit for this purpose really cannot be made as Mr. Hollands directs. That oil which is made most drying is the best for printers. By Mr. H.'s plan, the oil would remain greasy as ever; and setting it on fire, invariably darkens without improving the oil.

Oil for printers' ink should be boiled to the proper consistence with some good dryer, such as litharge, calcined sulphate of iron or copperas, &c.; but for colours in general, litharge is the best of these,

and is most commonly used. The quantity I have seen most successful, is two ounces to a gallon of oil, but many use a great deal more, I think uselessly. Linseed oil is the only oil ever prepared for printing, but common olive oil is often used unprepared, for the very commonest kinds of printing. F. C.

Volume 1, Page 319.

ALUM BASKETS.

The beautiful blues are not named by H. S. They are obtained by using sulphate of copper (blue vitriol,) instead of alum.

F. C.

QUERY, No. 8, Volume 2, page 30.

DISSOLVING INDIAN RUBBER, &c.

Ether dissolves it in large quantity: spirits of wine and spirits of turpentine in small quantity: and spirits of coal tar in abundance. The latter has for some time been used to dissolve it for making cloth water-proof. Cocoa nut oil softens it, so that it might easily be put into a mould of any description. The best plan is to keep the oil melted, by placing it near the fire.

F. C.

QUERY, No. 12, Page 31.

PIPE TO LAMP, &c.

I certainly conceive the plan suggested by Eff Ess will be of no sort of utility. The rarefied air will have so much less obstruction in a passage from the bell mouth than it would in a passage down the tube he names, that it would never pass the latter; and if it did, the disadvantages of throwing hot de-oxygenized air into the flame, need not be dwelt upon. F. C.

EXPIRED PATENTS.

Charles Hamond, for a machine for sawing, cutting, and planing wood. Expired June 27.

Thomas Atwood and Benjamin Cook, for a method of combining and connecting together different kinds of metals, and of combining and connecting metals and wood together, in such a way as to make the combination thereof, whether the same be of metals, or of metals and wood, have one appearance or representation only. Expired June 27.

Sir Howard Douglas, for an improved circle or semicircle. Expired July 2.

Ralph Sutton, for a self-acting curtain, or window blind rack. Expired July 2.

Robert Dawson, for a mode of applying any moving power to machinery, and of increasing such power, and of rendering machinery more easily susceptible of a multiplicity of such powers at the same or different times. Expired July 3.

Richard Waters, for a method of manufacturing pottery ware. Expired June 14.

NOTICE TO OUR READERS AND THE PUBLIC.

From the intense interest excited by the important proceedings of yesterday evening, upon the occasion of opening the New THEATRE of the LONDON MECHANICS' INSTITUTION, we are persuaded that we shall fulfil the unanimous wishes of our numerous readers and the public in general, by devoting a considerable portion of our pages to a copious, minute, and accurate report of every particular connected with an event, to which future ages will refer as an epoch in the progress of scientific knowledge. Our next Number will therefore contain the able address of the learned President of the Institution, Dr. BIRKBECK, with an ample detail of every other part of the proceedings of the evening, and the names of the illustrious and distinguished individuals who honored the ceremony with their presence. A full description of the Theatre itself will also be given, specifying its dimensions, its architectural construction, &c. and for the illustration of this part of the subject, Two Plates, elegantly engraved on steel, will be presented, representing, 1st. a correct view of the interior of the Theatre; 2nd. a longitudinal section; and 3rd. an accurate ground plan of the building. A double number must therefore necessarily be published next week, and as the above engravings on steel will be given in addition to the usual graphic illustrations, our readers must be sensible that a great additional expense will be incurred by the proprietor; but in this, as in every instance requiring extraordinary exertions, he will regret no pecuniary sacrifice to contribute to the gratification of the public, and add to the acknowledged value of the LONDON MECHANICS' REGISTER.

TO CORRESPONDENTS.

R. T. on English grammar has been received, but the subject has been so well illustrated by another correspondent, that we think the insertion of his letter unnecessary.

An Englishman's observations on M. Dupin's work are intended for insertion.

The length of Mr. Tatum's remarks on the lectures of Mr. Lewthwaite obliges us to defer their insertion till next week.

Herman's query is inadmissible.

We have had some difficulty in decyphering the communications of F. M. but we hope to insert them next week.

LONDON:—Printed by COWIE and STRANGE, 24, Fetter Lane.

laws among the laity. Let the teachers of youth be able fully to appreciate the bearings of the questions at issue; let them know that the enemy must be met by an acquaintance with his wiles and pitfalls, and by self-control, and there is no doubt that, their eyes once opened, they will discover the proper means and occasions for giving the necessary information to those committed to their charge. With Mr. Acton, we would raise our protest against

"Allowing men of a larger growth to remain in their present profound ignorance of all appertaining to sexual matters, except such as they may gather from experience, or the equally vague and erroneous conversation so often heard in smoking-rooms, at supper parties, or that equivocal and unscientific information read with such avidity in newspapers—as disclosed in divorce cases and actions for *crim. con.*"

Sexual excesses are the monster evil of the present, no less than of former times; it is not, except in particular forms, a subject for legislation, because legislation cannot reach it; but it is essentially a subject for the clergyman and the schoolmaster to deal with. It is folly to ignore what every man who has been at a school must know to prevail. It is wisdom to avail ourselves of the holiest aspirations of the youth to enable him to shun evil, not from fear—though from fear, if need be—but from a just appreciation of the immutable laws which may be traced equally in Holy Writ and in natural theology. We think Mr. Acton has done good service to society by grappling manfully with sexual vice, and we trust that others, whose position as men of science and teachers enable them to speak with authority, will assist in combating and arresting the evils which it entails, and thus enable man to devote more enduring energies and more lofty aims to the advancement of his race, and to the service of his God.

With these few remarks we would specially introduce Mr. Acton's book, which forms a separate edition of a part of the third edition of his larger work 'On the Urinary and Generative Organs,' to the favourable notice of our readers. We would desire to see its subject made a matter of meditation by many out of the profession, and especially by the teachers of our young generation.

"The continent student will find reasons for continuing to live according to the dictates of virtue. The dissolute will be taught on positive and irrefragible grounds the value of self-control. The married man will find advice and guidance, and the bachelor, who is often placed in a trying social position, will glean consolation from observing that not only are his sexual sufferings appreciated and understood, but that rules are given him for their mitigation."

These words, which we quote from the preface, indicate truly the scope of the work. Although it contains some passages which we think might be advantageously omitted, we are of opinion that the spirit which pervades it is one that does credit equally to the head and to the heart of the author.

Art. V.—*Medical Examinations and Physicians' Requirements Considered.* By Thomas Mayo, M.D., F.R.S., President of the Royal College of Physicians.—*London*, 1857. Pamphlet.

The character of examinations ought necessarily to vary with the objects for which they are instituted. As the introduction of competitive examinations into the Civil Service has roused public attention to the question, Dr. Mayo enters the lists to do battle in favour of the system hitherto pursued at the College of Physicians. Although we are not aware that the mode of examination followed by that ancient body has been impugned beyond the College doors, and do not therefore perhaps quite appreciate Dr. Mayo's motive for defending the system, we think with him, after considerable personal experience in the matter of examinations, that it is on the whole well adapted to determine the qualifications of candidates who desire to receive the stamp of the highest medical corporation of the country.

It would appear that the College of Physicians proposes, by its examinations, to ascertain whether a candidate for its license possesses a large practical acquaintance with disease, and a mind imbued not only with classical taste, but with that power of observing nature and appreciating vital and morbid phenomena in all their phases, which in itself is a proof of a thoroughly well-trained mind. If there is one thing wanting to render the examination of the College complete, it is that a further test should be applied of the practical tact and knowledge of the candidate, by allowing him to prove his aptitude at diagnosis and treatment at the bedside. Dr. Mayo, who is desirous to prevent the introduction of *competitive* examinations into the College, observes very justly, that

> "Nothing can be more fatal to the evolution of *continuous* thought, than at the age at which ultimate habits are forming, to be involved in the preparation of four or five departments of severe thought against an examination. Neither time nor occasion to *master* them, but every inducement to adopt the perfunctory process, which will secure well-compacted answers to probable questions, the mind leaving each part of the subject as soon as this point is gained. Such, I believe, has been the state of things, and its result, in many cases of University honours. The candidate grasps his prize before the subjects of it have had time to settle into his mind, and the books which he had for that purpose lie cold on his table for the rest of his life."

The tendency of competitive examinations is to induce the candidate to pay special attention to subjects which, however important in themselves, are more calculated to impart scientific distinction, than those qualities which are most required to fit the individual for the practice of his profession. Dr. Mayo's pamphlet in no way conveys that he underrates classical and mathematical attainments, and the study of the vast range of sciences auxiliary to medicine; he merely explains the grounds upon which he is opposed to the introduction into the College of Physicians of competitive examinations, and of examinations repeated at varying intervals.

The author concludes his observations with a graceful tribute to

those who have laboured to reform the organization of the medical profession in Great Britain; and we hope with him that if, at this late period, some slight differences may appear to linger between the various corporations whose interests are more immediately involved,

"The Government will exercise that most legitimate influence, by which the differences incident to every large body, made up of sections heretofore acting under separate banners, may be induced to yield to the general good."

ART. VI.—*New Remedies, with Formulæ for their Preparation and Administration.* By ROBERT DUNGLISON, M.D., Professor of the Institutes of Medicine, &c., in the Jefferson Medical College of Philadelphia. Seventh Edition, with numerous Additions.—*Philadelphia*, 1856. pp. 769.

AS a work of reference upon all new remedies, this is one of the most complete with which we are acquainted. The quotations of authorities are extensive, minute, and carefully given; and we are satisfied that no medical man would regret following our advice to acquire it, as daily opportunities will occur in which he may both test its value, and increase his own knowledge, in searching for the practical information it affords.

ART. VII.—*The Hygienic Treatment of Pulmonary Consumption.* By BENJAMIN W. RICHARDSON, M.D., Licentiate of the Royal College of Physicians, Physician to the Royal Infirmary for Diseases of the Chest and to the Margaret-street Dispensary for Consumption, Lecturer on Pathology at the Grosvenor-street School of Medicine, and Corresponding Fellow of the Pathological Society of Montreal.—*London*, 1857. pp. 115.

WE hold the opinion that, whether tubercle consists in a fatty degeneration of epithelium, in the exudation of an unorganisable fibrin, or of an excessive production of epithelial *débris*, the efficient cause of the disease is to be found in the prolonged inhalation of a vitiated atmosphere. Other influences may be at work to impair the tone of the muscle and the plasticity of the blood, but none of them are able to produce tubercle, unless the food that is offered to the lungs is deprived of its due amount of oxygen, or adulterated by the addition of carbonic acid, sulphuretted hydrogen, ammonia, or similar noxious gases. If this principle be conceded, it follows, as a matter of course, that whether we have regard to the prevention or the cure of the tuberculous diathesis, the first element for the physician to attend to is the provision of a pure atmosphere. The patient must be constantly surrounded by air, which enables all the vital processes to be carried out vigorously. Without pure air, the depuration of the blood must be defective; and if the surface of the pulmonary mucous membrane, the extent of the human ventilator, has once been diminished by the deposit of any material that interferes with the function

of respiration, the influence of atmospheric impurity will gain in noxious power in the ratio of a geometrical progression. Let all medical men ponder well upon the importance of pure air; let them unite to enforce the purification of the atmosphere outside our dwellings, and its free and unintermittent introduction into our rooms, and the misery and mortality resulting from tubercular diseases will be reduced in a manner which only those can estimate, even approximately, who are able fully to appreciate the physiological bearings of the process of respiration. But it will not suffice to wait till the oxygen is brought to us. We must go in search of it. We must encourage the metamorphosis of our tissues and the elimination of the waste products by exercise, while we supply healthy nutriment to the stomach, and provide against excessive waste and exhaustion, by proper clothing and due nightly rest. Dr. Richardson discusses all these elements in the physiological treatment of consumption in a healthful spirit; they are views which are, we believe, shared by many medical men, though they have not been, perhaps, so specifically brought to bear upon the treatment of pulmonary consumption as in the present instance. We shall gladly see the volume obtain a wide circulation in and out of the profession, because it is impossible to preach too widely and too frequently the superlative influence of pure air in the treatment and the prevention of disease generally, and of tubercular disease in particular.

The author divides his work into seven chapters. The first introduces the subject of the hygienic treatment of consumption; the second is devoted to the consideration of the supply of pure air as the first indication in its treatment, and the necessity of active exercise. Climate, dress, rest, form the subjects of the third chapter. In the fourth, the occupations and amusements of the consumptive patient are considered; while the importance of cleanliness, of abstinence from all kinds of sensual extravagances, the dangers of marriage on the part of consumptive females, are enforced in the fifth chapter, which concludes with remarks on diet, and the use of tobacco by phthisical patients. A few brief remarks on the medicinal treatment of the disease, in which Dr. Richardson well exposes the folly of seeking for a specific in the phthisis, occupy the sixth chapter. The seventh and concluding chapter is devoted entirely to a comparative examination of the various modes of artificial ventilation proposed, from the time of Dr. Hales downwards.

In taking leave of Dr. Richardson, we would thank him for the able addition which, in the book before us, he has made to the great edifice of sanitary science. It is here that our real strength lies. While we accept gratefully the beneficent agency of the contents of the Pharmacopœia, which Dr. Richardson, in our opinion, estimates at their true value, we know that the most powerful weapons that can be wielded against the inroads of disease and the devastations of premature death, are those which the patient too generally thinks least of, because they are at hand, and may be had without the intervention of a soothsayer or a prophet.

Art. VIII.—*The Structure, Functions, and Diseases of the Lungs.* By Thomas Williams, M.D., F.L.S., Physician to the Swansea Infirmary, Author of the Collegiate Triennial Prize Essay 'On the Structure and Functions of the Lungs,' and of the Article On the Organs of Respiration in the 'Encyclopædia of Anatomy and Physiology.' (Part I., Water and Air-lungs of Invertebrate Animals, and Aquatic Respiration.)—*London*, 1877. pp. 201.

The original of the present work, in the year 1842–3, procured for its author the high distinction of the triennial prize of the Royal College of Surgeons. That fact alone would make it imperative upon us to examine it with care, and place before our readers the results of the laborious researches of Dr. Thomas Williams. A cursory inspection shows the work to be one of no ordinary merit. For the present we must, however, content ourselves with announcing its appearance; we shall wait for the appearance of the second part, which will bring the physiological inquiries of the author, on the subject of the respiratory apparatus throughout the animal creation, to a close, and then seek to present to our readers the views and observations of Dr. Williams in a condensed form.

Art. IX.—*A Report upon some of the more Important Points connected with the Treatment of Syphilis.* By Holmes Coote, F.R.C.S., Assistant-Surgeon to St. Bartholomew's Hospital.—*London*, 1857 8vo, pp. 141.

The author enters upon an independent investigation of some of the phenomena of syphilis. We rejoice to see this fertile subject occupying the attention of hospital surgeons, and we trust that Mr. Coote will continue to pursue the inquiry he has commenced in that large field which is open to his labours.

In the introduction, Mr. Coote states that his experience does not confirm the doctrine, that a primary sore giving rise to suppurating bubo, is not usually followed by secondary symptoms. In illustration of this he instances the cases of eleven male patients in the venereal wards of Bartholomew's suffering with secondary syphilis; in two there had been suppurating bubo. There were also nine females, of whom four had had suppurating bubo.

We are compelled to observe, that these statements prove nothing with regard to the real point at issue. Were the suppurating buboes *specific*, or were they ordinary inflammations of the lymphatic glands, such as we know are constantly recurring from slight local injuries of any kind, especially in weak constitutions? Nothing but the test of inoculation could have proved that. If the secretion from the inguinal swelling were inoculable, the affection was specific, and the probability is that the constitution would not subsequently suffer, the virus being (such is one theory) eliminated by the lymphatic system. If it were not inoculable, the affection was probably a simple inflammation, between which and the chancre there is no ground for believing any

specific relation to have existed. That the latter was the true pathology of these cases, appears to us to be indicated by the author (although unintentionally) in the following remark:

"It must be remembered that women living on the streets are unable to rest at the commencement of their attacks of disease; and hence suppuration of the inguinal glands is by no means uncommon." (p. 11.)

The cause suggested explains the suppuration—a simple, not a specific one. Inability to rest would, in the same way, determine the existence of a suppurating gland after a scratch on the leg, or a sore corn. Without inoculation, the *specific* character of the inguinal swelling cannot be affirmed; and, wanting a knowledge of this important datum, no inference can be drawn respecting the nature of the process which has been set up there, whether it has been virulent or otherwise. Granting that these buboes were simply the results of local irritation, not of the specific poison (and this is certainly a probable view of the case), these cases entirely cease to controvert the doctrine which Mr. Coote disbelieves. A somewhat similar, but not identical doctrine, has been for some years past taught in Paris, and has in part been brought prominently forward in this country by Mr. Henry Lee, and as much of it as relates to this question—discussed as it is by Mr. Coote without reference to an observation of the primary sore—may be thus formuled—

A primary syphilitic sore, followed by three or four small indurated glands, without tendency to suppurate, is almost certainly followed by secondary symptoms.

A primary sore, followed by one acutely inflamed gland, which suppurates *and is inoculable*, is, on the contrary, rarely followed by infection of the system.

But then it is unphilosophical to regard this question of bubo separately from the character of the sore which gave rise to it. The first-named sore is the indurated chancre; the second is the non-indurated, non-infecting, but most common variety. Each has its own specific action upon the lymphatic glands, as described above: the first alone extends to the system also, and gives rise to secondary symptoms; the virulence of the second does not go beyond the suppurating gland. Either may give rise (from irritation, as of walking, or without it in certain constitutions) to a simple gland enlargement and abscess, but without specific virus in the pus. Hence a non-indurated chancre, followed by acute gland suppuration, the pus of which will produce a similar chancre, is never followed by secondary symptoms. Such is the doctrine referred to—a doctrine demonstrated and emphatically taught by Ricord, and which our own experience corroborates the truth of; but it is widely different from that which has been enunciated in its place by Mr. Coote, for purpose of disproof; viz., that—

"In those instances in which the irritation of the lymphatic glands is the greatest, and where, consequently, we have the best evidence that the morbid matter has entered them, there is very seldom any secondary syphilitic affection." (p. 10.)

But the author does, in the case of the men only, refer to the cha-

racter of the sore, stating that "not one had the true indurated chancre. The primary sores were superficial ulcerations of the glans and prepuce, *leaving cicatrices*, and one case of primary phagedæna."

The italics are our own. The fact of the non-induration is affirmed, not on observation of the sore, but of its cicatrix. Nothing can be more doubtful than the inference. "But," the author proceeds, "in most cases the patients stated that the glands in the groin swelled up for a week or more, and then subsided." This is the very form of gland-enlargement, pointed out in the formula above, as characteristic of the indurated chancre, and is strong evidence, in absence of an actual observation of the primary sore, that such was its nature in the "most cases" adduced.

Passing to another topic, we learn that Mr. Coote adheres to the belief that gonorrhœa is the result of a specific poison. He quotes the following case as proving that "its existence retards, as it were, the action of the syphilitic virus." (p. 31.) A patient was admitted to the City Bridewell with gonorrhœa of fourteen days' standing. After three weeks' residence it left him, and very soon "a superficial non-indurated venereal sore" appeared on the skin of the under part of the penis. There could have been no fresh infection from the other sex. The source of this sore is then discussed by the author, who doubts that in this case intra-urethral chancre complicated the gonorrhœa, but that the sore on the penis was due to syphilitic virus, the incubation of which had been delayed by the first-named complaint, because

> "There were no symptoms whatever of ulceration of the urethra; there was not excoriation at the orifice, nor induration along the canal, nor pain upon pressure, nor any sign by which such an occurrence could be suspected."

Surely we cannot forget that many infecting sores seen on the exposed part of the penis possess no characters by which it would be possible to determine their existence by any physical examination, supposing them to be seated within the urethra, and beyond the reach of vision. We cannot doubt that this was a case by no means rare, of gonorrhœa co-existing with intra-urethral chancre, of the ordinary non-indurated form, by which the skin of the penis was subsequently inoculated. That the two things do co-exist has been proved a hundred times by Ricord—a fact familiar to those who know his practice.*

In asserting the existence of but one syphilitic virus; that the character of the sore is determined greatly by the natural structure of the part in which it is situated; that the occurrence of phagedæna depends much on the constitution of the individual; and that the course of secondary symptoms is not to be predicated, Mr. Coote opens up topics, to enter upon the consideration of which would require very extended limits. Some of these positions are regarded by very high authorities as requiring modification, under the light which has, during the last few years, been thrown upon the subject of syphilis.

Nothing new transpires respecting treatment. The plan commonly followed by the author consists in that invaluable resource, early cau-

* See also his Lettres sur la Syphilis. Paris, 1851. The fourth to the eighth, inclusive.

terization and moderate mercurialization, when the chancre is indurated. To the value of the Turkish bath, "which may now be procured in London" (p. 109), for stimulating the cutaneous function, in the treatment of secondary symptoms, we are glad to have this opportunity of bearing a corroborative testimony. The successive applications of hot vapour, soap, thorough friction, and water douches, of which our own metropolitan form of that Oriental luxury consists, constitute, when made with proper precaution, a powerful means of elimination from that vast and important organ, the skin, the benefit of which we have had opportunities of witnessing in some cases, and desire to extend.

In conclusion, although obviously disagreeing with Mr. Coote on some fundamental doctrinal points in the pathology of syphilis, we regard this essay as a record of thoroughly practical labour, and most assuredly desire to thank him for the search after facts which it is evidently always his object to attain.

ART. X.—*Archiv für Ophthalmologie.* Erster Band, Erste Abtheilung, herausgegeben von Dr. A. VON GRÄFE. Zweite Abtheilung, herausgegeben von Prof. F. ARLT, Prof. F. C. DONDERS, and Dr. A. VON GRÄFE.—*Berlin*, 1854–5. pp. 358. Zweiter Band, 1855–6. pp. 346. Dritter Band, Erste Abtheilung, 1857.

The Archives of Ophthalmology. Vol. I., Part 1, edited by Dr. VON GRÄFE. Part 2 edited by Prof. ARLT, Prof. DONDERS, and Dr. VON GRÄFE. Vol. II. Vol. III., Part 1.

WE owe an apology to our readers for having so long delayed noticing this new organ of ophthalmic science. It is in every way a worthy rival of the well-known 'Annales d'Oculistique,' which for so many years have been the medium of communication between Continental ophthalmologists and the profession at large. There is ample room for both publications to labour harmoniously in the same field, which they cultivate in a somewhat different manner. While in the 'Annales' the reader is kept *au courant* with the literature and ophthalmic news of the day, the 'Archiv,' instead of aiming at the character of a journal, rather resembles the 'Transactions' of our medical societies.

The volumes now before us contain several essays of sterling merit, and the chief editor, von Gräfe, has contributed a rich collection of miscellaneous cases from his public and private practice. Associated with him as contributors, we find the well-known names of Helmholtz, the inventor of the ophthalmoscope, von Ammon, Rass, Donders, Liebreich, Zehender, and others. Among many papers of interest in Vol. I., we may notice a careful essay by von Gräfe On the Action of the Ocular Muscles; and his miscellaneous notes of cases are all more or less interesting. He has been so fortunate as to detect, by the aid of the ophthalmoscope, the presence of entozoa—*cysticercus cellulosæ*—within the vitreous chamber. No fewer than nine cases of this singular affection have come under his observation; the entozoa being either fixed to the retina, or floating freely in the humours of the eye. We

are not aware of such cases having been met with by any other observer, either in Germany or elsewhere. Among the essays in Vol. II. we may specially notice a very elaborate one, by Dr. Meissner, On the Movements of the Eyeball; a Contribution towards the Histology of the Choroid, by Dr. Wittich; and a further Series of Cases, by Dr. von Gräfe.

Only one-half of Vol. III. has yet appeared; but it well sustains the character of the work by the variety and interest of its contents. Dr. H. Müller contributes original researches On the Anatomy of the Ciliary Body and the Mechanism of Accommodation; the Histology of Capsular Cataract, &c.; Dr. Zehender, a paper On the Refracting Powers of the Media of the Eye; Dr. Donders continues his Pathological Contributions; and Dr. von Gräfe, in an article of more than two hundred pages, commences a review of the whole question of Strabismus, and the operations for its cure.

We heartily wish success to a work which so well sustains the high character of German ophthalmology; and we shall not fail, from time to time, to lay before our readers some of the more important facts recorded in its pages.

ART. XI.—*Notes on the Belgian Lunatic Asylum, including the Insane Colony of Gheel.* By JOHN WEBSTER, M.D., F.R.S., &c.—pp. 68.

To the philanthropist, we know no subject more gratifying than the treatment of the insane, and the management of lunatic asylums as at present conducted, compared with the past of no remote date. We are old enough to remember the time when chains were in use,—when punishment was considered necessary, and coërcion essentially so. We would fain hope that the progress which has been made in this most important branch of medical practice, and which is mainly due to the exertions of enlightened physicians, betokens not only an advance in the right line, but may be viewed also as some makeweight against the degrading influences of the various delusions which have of late prevailed, and are still prevailing, in society, under the names of mesmerism, table-turning, spirit-rapping, and the like,—delusions which, one after the other, have started up, as if to show the weakness of human reason, and to check us in our too lofty aspirations regarding its efforts.

The lunatic asylums in Belgium, it would appear, from the account given of them by Dr. Webster, in his interesting 'Notes,' are an example of the progress we have alluded to, and are perhaps as good an example as could be adduced in any part of the *civilized* world; and we say civilized with emphasis, for where there is want of civilization, there we are sure no humanity is shown to the suffering insane. We may mention in proof that in Constantinople, a very few years ago, we had the pain to witness lunatics, chained like wild beasts, made a sight of, and allowed to be the sport of mischievous boys, and separated only from a menagerie by an intervening wall.

In Belgium, this progress, this change of system from severe to mild, we learn, has only been effected within the last five or six years.

In 1852, we are assured by a native writer, M. Guislain, in his lectures, 'Sur les Phrénopathies,' that "Lunatics in Belgium remain forgotten in sombre prisons;" that

"They resemble merchandize amongst speculators, who make them the objects of nefarious traffic, like animals from the farm-yard, fit only to be bought and sold as horses or swine."

Adding,

"Much talk has certainly taken place during the last thirty years; but so little has yet been accomplished, that our afflicted maniacs have only been turned round in a vicious circle of selfish and fatal administrative influence." (p. 11.)

We must refer to Dr. Webster's Notes on the several asylums for the particulars of the beneficial change, briefly remarking that it is connected with a radical change of the administrative system, organized as a public department, and directed by rules founded on just views of the malady; of the more important of these rules a summary is given by the author. The inspection of the asylums, whether public or private, at least three times yearly, by a different class of persons, and the sanction of the Government for the erection of new, or for alterations even in existing, asylums, are particularly worthy of attention.

Belgium is a country of all others distinguished for its mixed breed of people; nowhere, not even in England, have races been more crossed; yet in Belgium it is worthy of remark, that the proportion of the insane is large—larger than in England, and indeed than in most countries of which we have trustworthy statistics. In a population of about 4,520,000, the number of recognised lunatics was recently 4907; in towns, in the proportion of one for every 470 residents; in the country, one for 1368 inhabitants. In regard to sex, too, it is worthy of remark that the male preponderates, their number being 2630 to 2277 females.

The unusual prevalency of insanity in this country seems to be owing to various causes: those on which the author lays most stress are poverty—poverty especially—and vice; the former conducing to it by a low and inadequate diet; the latter, through the intemperate use of ardent spirits and tobacco, and sensual excesses.

We trust that all who take an interest in the subject (and who are they who ought not to take an interest in it?) will read Dr. Webster's remarks in their details. The few remarks we have to offer must be limited chiefly to the "Insane Colony of Gheel," the oldest establishment for maniacs in Europe, which on many accounts is deserving of special attention, and most of all by our Government, and of all under it exercising authority in matters of lunacy.

The great peculiarity of this colony, of which the town of Gheel is the centre—situated in a country, a barren waste by nature, rendered fertile by industrial labour, and partly by that of the insane themselves—is, that the lunatics sent there become the inmates of private families. At the time of the author's visit, the number of the receiving families was 500, of which about 300 possessed cottages or farm-houses in the country, the rest residing in the town. The

number of lunatics thus distributed was 774. Dr. Webster, speaking of their distribution, says:—

"I visited numerous houses in the town, and a great many cottages scattered over the adjoining country, in which often one, although most frequently two, and occasionally three, insane persons resided."

Adding,

"That is the general system followed, with but very few exceptions,—seeing not more than five instances exist throughout the entire colony where beyond four patients are placed with the same family, but only then for special reasons, and after an express authorization from the Committee of Inspection is obtained." (p. 41.)

This unique colony is as singular in its origin as in its nature. Its origin goes back to a remote period, and to a tragic and atrocious act—the flight and beheading of an Irish princess—a saint and virgin, St. Dympna, in the sixth century, by a king, her father, a Pagan, and, something worse, amorous of his child, and enraged at her virtuous resistance, and to her change of religion and firm adherence to Christianity. The cruel acts perpetrated on her, according to the legend,

"Greatly frightened several lunatics said to be present, and, tradition reports, cured them immediately, through the strong impression this terrible spectacle produced on their excited feelings. Immediately the cry of 'A miracle! a miracle!' was raised by the wondering bystanders; and thus Dympna, saint and virgin, became ever after the patron of all mad persons. This faith having been spread abroad, lunatics were brought to Gheel to get cured through St. Dympna's intercession, and firmly established its reputation." (p. 32.)

Our readers may be interested to know that Gheel is now easy of access; that it may be reached from Brussels, by rail and a daily two-horse omnibus, in the short space of two hours and a half, and that in the town there are two inns, both good, affording very comfortable accommodations, and on surprisingly reasonable terms; three francs per diem—we record it as a matter of curiosity—covered the entire hotel charges of our author.

Amongst the more remarkable circumstances noticed by Dr. Webster in describing this colony, is the part taken by children in the service and management of the insane, the security attending the freedom allowed the patients, and their few escapes, and the many and useful occupations on which they are employed. The particulars on these points, and on others given by the author, we have read with extreme interest; and we can recommend the perusal of them to others, confident that they must excite in them the same feeling; and more, that much in the system that distinguishes the colony of Gheel is worthy of the serious attention of our Government officials, and of being followed in our establishments for the insane.

We see that Dr. Webster raises his voice against palatial asylums constructed at an enormous amount of expense, burdening the rate-payers, without perhaps commensurately benefiting those unfortunates for whom they are designed; and the placing them, at a like extravagant cost, not on waste grounds, such as the locality of Gheel was, but on already reclaimed or fertile land of high marketable value, capable of little further improvement.

ART. XII.—*On the Diseases, Injuries, and Malformations of the Rectum and Anus.* By T. J. ASHTON. Second Edition.—*London,* 1857. 8vo, pp. 390.

THE rapidity with which the works upon diseases of the rectum, by Curling, Quain, and the present author, have passed into second editions, testifies at once to the prevalence of these affections, and to the insufficiency of the accounts given of them in the general treatises upon Surgery. Mr. Ashton's work must be regarded as the most complete one we possess upon the subject; and while he exhibits in it a considerable acquaintance with what has been written by others, the practical facts he contributes quite prevent the treatise being characterized as a mere compilation. We have heard it objected that it has been too much based upon the work of the late Dr. Bushe; but even were this true, which we do not think it is, it would in our eyes constitute rather a merit than a reproach. Dr. Bushe's treatise, though highly valued by those acquainted with its contents, never met with that general acceptance it deserved; and the wider diffusion of his views by an intelligent critic and a good practical surgeon would be very desirable.

Mr. Ashton's style is somewhat too diffuse, and his book would have gained by compression; but, even with this drawback, it well deserves the success it has met with.

ART. XIII.—*Practical Hints on the Management of the Sick-room.* By R. HALL BAKEWELL, M.D., Member and Licentiate in Midwifery of the Royal College of Surgeons of England, L.S.A.; formerly House Surgeon to the Middlesex Hospital, and to the Stafford County Infirmary; late of the Medical Staff in the Crimea; author of letters of 'Sanitary Reform in Rural Districts.'—*London,* 1857. pp. 47.

DR. BAKEWELL informs us, that when a patient lies in bed "very little waste is going on in the system, and that that part of the food which is required for sustaining animal heat is almost wholly unnecessary—artificial heat being supplied." Does this mean that people who are confined to bed invariably use, or ought to use, hot water-bottles and stomach warmers? Again, Dr. Bakewell, in speaking of "mustard plasters," says only they "should always be made with fresh mustard and cold water;" in a book intended specially for "lady readers with lily-white hands," we should have thought that some further information on the subject would have been necessary. We know from experience that such information would not have been thrown away. One more specimen of the instruction conveyed by Dr. Bakewell, and we have done: in speaking of pills, the observation "that it is advisable to take some fluid afterwards in order to assist in dissolving them in the stomach," is followed by the statement, that "it is better to take aperient pills immediately after a meal, as then they are digested with the food."

We think the above instances suffice to show that Dr. Bakewell has not yet attained a position which justifies his offering himself as an instructor to the public; and we would suggest for his consideration, that in order to become a successful popular writer, it is not enough to publish a mere *réchauffé* of scanty notes taken at school lectures.

Art. XIV.—*Summary of New Publications.*

During the past three months we have received, in addition to the works already spoken of in other parts of the Review, numerous productions of more or less value in medicine, surgery, and the allied sciences. Hygiene, we are happy to find, rejoices in an increasing body of powerful supporters. The Medical Officers of Health of the City of London, Hackney, Whitechapel, St. Pancras, St. Luke's, Chelsea, and Islington, have published valuable Reports; and with them we may mention Mr. Blyth's 'Minute of Information on Disinfection,' Mr. Gamgee's 'Letters on the Cattle Plague and Diseased Meat,' and Dr. Greenhow's 'Report on Murrain in Horned Cattle,' presented to Parliament.

In Medicine, we direct especial attention to the third edition of Dr. Budd's work 'On the Diseases of the Liver,' which has fairly established for itself a place among the classical medical literature of England. The pathology of fever is represented in Dr. Bartlett's work, 'On the History and Diagnosis of Fevers in the United States,' the original edition of which was reviewed at length by one of our predecessors.* Dr. Evans Reeves has published a volume 'On Diseases of the Stomach and Duodenum;' while cardiac pathology finds exponents in Dr. Cockle and Dr. Markham, the former having published a paper 'On the Second Sound of the Heart,' the latter having re-issued 'Contributions to Cardiac Pathology,' which first appeared in a cotemporary periodical, and the details of which will be found in the Quarterly Medical Report. Dr. Gull has republished in a separate form, the cases of paraplegia which have recently appeared in the 'Transactions of the Medico-Chirurgical Society,' and in the 'Guy's Hospital Reports.'

An elaborate memoir by Dr. Tholozan, 'On Metastasis,' has reached us from Paris. The author regards the cases, commonly set down as metastases, as manifestations of the fundamental diathesis, and as independent of the other localizations of disease as these are of one another. An elaborate 'Report on the Recent Epidemics of Cholera,' has appeared, by the pen of Dr. Hirsch, of Danzig, already favourably known as an earnest inquirer. Climatology is represented by Mr. Edwin Lee, who has published a *brochure* on the Hyères, the Isle of Wight of France; by Mr. Smart and Dr. Aitken, who have respectively written on the climates of the Crimea and of Scutari.

We may here also mention a book on the theory and treatment of stammering, by Mr. Urling, which has much to recommend it, entitled 'Vocal Gymnastics.' Dr. Gairdner has thought it necessary to continue the controversy between medicine and homœopathy which

* See British and Foreign Medico-Chirurgical Review, vol. xviii. p. 357.

he so ably commenced in the 'Edinburgh Essays.' We would earnestly recommend him, and all others who may be tempted to take up the cudgels, to act upon the principle enunciated in a passage of Dr. Gairdner's 'Few Words on Homœopathy,' and allow homœopathists "to remain, like the cuttle-fish, safe in their own ink." Even the cuttle-fish would choke if the sea did not wash away its ordure.

In Surgery, we have received a new work 'On Stricture,' by Mr. Henry Smith; the publication by Dr. Fell of the method adopted by him of treating cancer by the local application of caustics, has allayed all feverish excitement with regard to the subject, an excitement which the result scarcely appears to justify, either in a pathological or in a therapeutic point of view. Mr. Wharton Jones has brought out a 'Catechism of Ophthalmic and Aural Medicine;' a second edition of Mr. Hare's very useful Cases and Observations, illustrative of his mode of treating spinal deformities, and to which we drew attention in our April number, has already appeared. From abroad, Dr. Gay's 'Surgical Cases,' a reprint of a paper in which four cases of tumours of the extremities are discussed, have come to hand; with a French translation by M. Gosselin, of Mr. Curling's well-known work 'On the Testis,' with additions by the editor; an important work by M. Broca 'On Aneurism;' and another, deserving of attention, by Dr. Benedict, of Stockholm, 'On Hernia.'

The literature of Mental Pathology has received a ponderous contribution, in the shape of two large Blue-books, containing the 'Report of the Scottish Lunacy Commissioners,' which have already excited public attention by the abuses which they expose; Dr. Hood's 'Decennial Report on the State of Bethlehem,' also deserves mention.

An able treatise 'On the Wave Theory of Light,' by Dr. Lloyd, will, with many of the works previously mentioned, receive fuller attention at an early opportunity; we shall also have a word to add concerning Mr. Fenwick's popular treatise, 'On the Causes and Prevention of Disease,' and of an iatro-theological volume by Dr. Duncan, entitled 'God in Disease.'

Periodical literature boasts of numerous accessions. The most imposing is a quarterly medical review, published in Birmingham, under the title of 'The Midland Journal,' the first number of which contains several papers by well-known surgeons and physicians. The dentists have brought out the first number of a 'Quarterly Journal of Dental Science,' which represents those of the fraternity who hold it better to constitute themselves a distinct body than to be associated with the College of Surgeons. The Imperial Society of Constantinople is represented by a monthly paper, bearing the title of 'Gazette Médicale d'Orient,' the first number of which contains the commencement of an original article on miliary fever, by Dr. Tian, the *compte-rendu* of the Society during the first year of its existence; and a brief review of the cotemporary medical press. Our Dutch *confrères* have also issued a new periodical, under the title of 'Nederlandsch Tijdschrift over Geneeskunde,' under the authority of the Amsterdam Society of Medicine.

PART THIRD.

Original Communications.

Art. I.

Contribution to the Physiology of Saccharine Urine. On the Origin and Destruction of Sugar in the Animal Economy. By George Harley, M.D., F.C.S., of University College, London.

In the summer of 1853 I communicated to the Société de Biologie de Paris the discovery of a new method of producing diabetes artificially in animals, by means of stimulants introduced into the portal circulation. Since that time I have frequently repeated, and even extended, my experiments with similar satisfactory results.

It is generally admitted by physiologists that the various secreting organs in the animal body are stimulated to perform their different functions either by a direct or by a reflex nervous action; and it has been said by Professor Bernard that the normal production of sugar in the liver is dependent upon the latter kind;—a stimulus being transmitted by the pneumogastric nerves to the brain, and reflected along the spinal cord and sympathetic nerve to the hepatic organ. M. Bernard was led to this conclusion by finding that immediately after section in the neck of *both* pneumogastric nerves, the liver not only ceased to secrete, but even the sugar contained in the organ at the time of the operation gradually disappeared. The division of only *one* of the pneumogastric nerves produced no visible effect upon the glucogenic function of the liver; and if a sufficient length of time for the re-union of the divided nerve, eight or ten days, were allowed to elapse, a section of the opposite pneumogastric might be made without causing any interruption of the saccharine secretion. He further observed that the application of galvanism to the upper ends of the divided nerves not only re-established the secretion of sugar, but if the current were continued a sufficient length of time, augmented it beyond the normal amount,—so much so that animals thus operated upon not unfrequently became diabetic. On the other hand, the application of galvanism to the lower ends of the divided nerves was not found to be followed by any such result. These experiments clearly indicated that the nerve-force which excited the liver to secrete saccharine matter did not travel from the brain, through the pneumogastric nerves, to the hepatic organ; but rather that the stimulus proceeded along these nerves to the brain, and was from thence re-transmitted to the liver by some other nervous chain.

The data yielded by other experiments, which it is at present unnecessary to recapitulate, induced M. Bernard to adopt the opinion, that in a healthy animal the reflex action which incites the liver to secrete sugar originates in the stimulus given by the respired air to the pulmonary branches of the pneumogastric nerves. He believes, in fact, that at each act of inspiration the tender filaments of the pneumogastric nerve distributed in the lungs receive from the inhaled gases a stimulus, which is transported through the trunks of these nerves to the brain, and reflected from the nervous centre along the spinal cord and splanchnic nerves to the liver. The point of departure of the normal nerve force which calls into play the glucogenic function of the liver, may at the first glance appear a matter of little moment; but when we consider that the secretions of organs increase in proportion to the amount of stimulus applied to their nerves, and that an excess of secretion which not unfrequently constitutes disease, arises in many cases simply from an exaggeration of the normal stimulus, we shall at once acknowledge the importance of thoroughly understanding the physiological, before attempting to remedy the pathological, condition of any organ. When an answer has been given to the query, "Where is the sugar secreted?" the question next in importance to the physician is most assuredly, "By what means is the secretion excited?" A satisfactory answer to the latter question may not improbably furnish a guide to the successful treatment of a disease which has so long been regarded as ungovernable.

At present a great diversity of opinion seems to exist with regard to the cause of saccharine urine. Some authors speak of it as dependent upon a morbid condition of the liver, others as the result of disease in the nervous system, while a third class still adhere to the old opinion of its arising from disordered digestion. They appear altogether to ignore that one and the same symptom may spring from a multitude of causes, and that as saccharine urine is not of itself the disease, but only the most prominent symptom of a hidden complaint, it too may be the product of a variety of morbid actions quite distinct from each other, and consequently requiring diametrically opposite treatment. If, for example, the normal stimulus of the liver is exaggerated, an abnormal amount of sugar will be secreted; and if the quantity formed is greater than the amount requisite to supply the wants of the system, the excess which then acts towards the organism as a foreign body, will be eliminated with the urine, and the disease, diabetes mellitus, established. If, on the other hand, the stimulus, instead of being exaggerated, is abnormally feeble, a less amount of sugar will be produced by the liver than the wants of the system demand, and a disease which as yet we possess no means of recognising, will be the result. The presence of sugar in the urine does not, however, necessarily prove that the glucogenic function of the hepatic organ has been exaggerated. For even in cases where only the normal amount of saccharine matter has been formed, the sugar in the blood may be present in excess, in consequence of some diseased state of the system preventing its assimilation. In such cases the sugar will gradually accumulate in the

blood, until at last the excess circulating in the body will act as a foreign material, and as such be eliminated by the urine.

Diabetes mellitus may further originate, either in such a change in the structure of the parts which secrete the saccharine matter as will admit of their performing more than the ordinary amount of labour, or in some organic change in the nerves which call the function into action, causing them to over-stimulate the sugar-forming apparatus. There are yet other two causes of diabetes sufficiently important to be here noticed. The first may originate in a foreign stimulus, in addition to the normal one, directly applied to the liver; the second, in such an artificial irritation of the nerves, as will excite them to communicate an excessive stimulus to that organ. A good example of the latter cause is to be found in the experiment performed by Reynoso, who discovered that by making an animal breathe irritating or stimulating vapours, the reflex nervous action might be increased to an extent sufficient to produce an exaggerated secretion of sugar, and to render the animal so operated upon for a time diabetic. This fact has been adduced by Bernard as a strong proof of the correctness of his view with regard to the origin of the normal reflex action. Without wishing to question the fact that irritation of the respiratory organs in animals produces a flow of saccharine urine, it may be remarked that, in making similar experiments, I have not found it so easy to arrive at the same satisfactory results which Bernard seems to have obtained. For example, I caused a robust rabbit to inhale sulphuric ether during seventeen minutes. In twenty minutes afterwards, and again in one hour and a half, the urine was tested without the slightest trace of sugar being detected. To another adult healthy rabbit, in full digestion, I slowly administered chloroform until he became completely insensible,—indeed, much difficulty was experienced in restoring him. Two hours afterwards the urine was tested for sugar, with no better success than in the previous case. I compelled another rabbit to inspire ammoniacal vapours during five minutes, without being able to produce a flow of saccharine urine.

As the ill-success attending these experiments might arise from not giving a sufficiency of the respective stimulants, I administered to other rabbits a very much larger quantity; and in one case, the most satisfactory, I succeeded in detecting a small quantity of sugar in the urine. This result was not, however, attained until after I had rendered the animal five times completely insensible within twelve hours, by a mixture of chloroform and ether.* This success, although it confirms the observation of Reynoso, that the secretion of sugar may be augmented by an irritation applied to the pulmonary branches of the pneumogastric, even taken in connexion with the result of section of the cervical pneumogastric, does not appear to me to justify the conclusion of Bernard—that in the normal state, respiration is the excitor of the glucogenic function of the liver.

* Cases have been reported of sugar appearing in the urine of patients after the administration of chloroform; but as this paper is a mere contribution to the physiology of saccharine urine, I refrain from entering fully into details.

Every one knows that in exciting reflex action in the limb of a decapitated frog, it is perfectly immaterial to which branch of the sensory nerve the irritation is applied. There is thus no difficulty in accounting for the liver being excited to secrete sugar when an irritation is applied to the pulmonary branches of the pneumogastric; and we are not necessarily forced to believe that they are the branches which normally call into action the peculiar function of the organ referred to. Indeed, if such be in reality the case, how does it happen that while the respiration, and consequently the stimulus, continue at about the same rate during the entire day, the secretion, which is said to be the result of the stimulus, varies at different times? At one hour it is known to be exceedingly active; at another, a somewhat later one, almost dormant. Such a result has no parallel in any other organ of the body. A certain amount of stimulus, *cæteris paribus*, invariably calls forth a similar and definite amount of action; and upon what grounds are we warranted in considering the function of the liver an exception to the general rule? I need scarcely detain the reader at present with further arguments against what appears to me an untenable hypothesis, as I believe the results of the subjoined experiments clearly indicate, that *if* the pneumogastric is the nerve which carries the stimulus to the brain, to be from thence transmitted by the spinal cord and splanchnic nerves to the liver, the point of departure of the stimulus is most probably in the liver itself, and that the cause of the reflex action may originate in the stimulating effect of the portal blood upon the hepatic branches of the pneumogastric nerve. If, for example, the stimulating effect of the blood of the portal vein be imitated as much as possible by injecting into that vessel substances such as alcohol, ether, chloroform, methylated spirit, or ammonia, the liver is excited to secrete an excess of sugar, and the animal operated upon is for a time rendered diabetic. The following experiment illustrates this fact very clearly:

I injected ten cubic centimètres of sulphuric ether, mixed with thirty cubic centimètres of water, into one of the branches of the portal vein* of a full-grown Newfoundland dog, half-an-hour after he had been fed. When he rose up after the operation he appeared intoxicated, and staggered a little as he moved about. This effect, however, soon disappeared, and in a few hours the animal looked as if nothing had been done to him. In two hours after the injection was made I passed a catheter into his bladder, but did not obtain sufficient urine to enable me to satisfy myself whether it contained sugar. Some hours afterwards, when I had obtained enough urine, I found that it readily reduced the copper in Barreswil's liquid, thus indicating the presence of saccharine matter. To assure myself that this effect was not due to the presence of any other substance, I boiled the urine in order to coagulate the albumen, of which it contained a little, then evaporated it almost to dryness, dissolved the residue in boiling alcohol, and filtered. The filtered liquid was next evaporated to drive off the alcohol, and an aqueous solution made. On testing the latter for

* The experiment is very easily performed by using a sharp-pointed syringe, which can be pushed with facility through the coats of one of the large mesenteric veins.

sugar with the sulphate of copper solution, its presence was clearly indicated. Although by this method the existence of saccharine matter was rendered almost undeniable, I still wished to convince myself of its presence by some other means. The urine which the dog passed the next day was therefore fermented, and carbonic acid gas and a trace of alcohol were obtained, thus placing beyond a doubt the existence of sugar in the urine. In consequence of the dog breaking his chain and escaping, I am unable to state how long he remained diabetic; but he was certainly in that condition forty-eight hours after the injection of the sulphuric ether.

The following case, of which I shall speak very briefly, proves the presence of sugar in the urine until the third day after the operation: A very large dog (the largest I ever saw) was treated in the same way as the preceding one, but he appeared to suffer much more from the operation. His urine was so loaded with bile that I was forced to decolorize it before testing it for sugar with the tartrate of potash and copper, which however it readily reduced. I also fermented the urine, and was able to convince myself of the existence of saccharine matter in it until three days after the injection had been made.

In another case I injected nine cubic centimètres of ether, mixed with thirty cubic centimètres of water, into the portal vein of a small dog. He became insensible, and continued so during a few minutes. Twenty-four hours afterwards he was killed by section of the medulla oblongata, and in his urine the presence of sugar was detected, both by the fermentation and by the copper test.

The following case shows how ammonia has the same power as ether in causing the liver to secrete an abnormal amount of saccharine matter:

Into the portal vein of a good-sized dog, in full digestion, I injected fifteen drops of liquor ammoniæ, diluted with forty cubic centimètres of water. In twenty hours afterwards, on the animal being killed, his bladder was found enormously distended with urine, which not only reduced the copper in the liquid of Barreswil, but fermented most rapidly.*

I have on several occasions repeated the experiment with ammonia, and have not yet met with a single unsuccessful case. Attempts with chloroform, on the other hand, are not invariably successful, as they sometimes result in the death of the animal, especially if the dose be considerable, as the following example proves:

Into the portal vein of a large sheep-dog I injected a mixture of three grammes of chloroform, ten cubic centimètres of ether, and fourteen cubic centimètres of water. He died three hours after the operation. Notwithstanding this untoward circumstance, I found that the urine remaining in his bladder after death contained a certain amount of sugar. In operating with chloroform, it is best to use only a few drops, as then the animals seem to suffer but little inconvenience.

In another experiment I injected into the portal vein of a small

* This and the preceding experiment I had the honour of performing at the College of France, before a commission appointed by the Société de Biologie, and consisting of Profs. Bernard, Robin, and Verdeil.

dog ten cubic centimètres of a liquid composed of equal parts of alcohol and water. Two hours afterwards I examined the urine, and found that it contained sugar, but in small quantity. As I had great difficulty in obtaining the urine of this animal, I ceased making any further observations on him.

Into the portal vein of another dog, of the Skye-terrier breed, I injected ten cubic centimètres of the common methylated spirit, diluted with thirty cubic centimètres of water, six hours after he had eaten a full meal. For a few minutes after the operation he appeared to be intoxicated; but this effect soon disappeared, and on the following day he seemed perfectly well. When he was killed, his bladder was found distended with pale-coloured urine, which contained a considerable amount of sugar, as was seen by the quantity of copper it reduced, and the facility with which it fermented.*

It may be here mentioned that all the dogs so treated vomited after the operation, from the irritation, no doubt, of the pneumogastric nerves.

These experiments are selected from a number of others, which it is quite unnecessary to cite, as the results obtained were identical. From the total of my experiments upon this point, I conclude—firstly, that a flow of saccharine urine can be induced by means of stimulants introduced into the portal circulation, even in animals that have been fasting during twenty-four hours; and secondly, that the introduction of these stimulants sometimes produces albuminuria and an increased discharge of bile, as well as of saccharine urine.

The question now to be considered is, "In what manner do the stimulants act—is it directly, by exciting the tissue of the hepatic organ, or indirectly, through the nervous system?"

The assertion, that an organ like the liver can be excited to perform its function without the intervention of the nervous system, may appear to some as unwarranted. Indeed, were it not that we already know muscles to possess a contractile power altogether independent of nervous influence, I should not have dared to hazard such an opinion. Bernard, however, has clearly demonstrated, on frogs poisoned with wourali, that although the influence of the nervous system can be totally destroyed (as is seen by the muscle not contracting when the nerves are galvanized), galvanism, applied directly to the muscular fibre itself, excites immediate and violent contraction. I have frequently had occasion to repeat this experiment, and am well satisfied of the justness of Bernard's conclusions. In the case of the muscle we have, therefore, indubitable proof that the specific property does not exist in the nerves, but in the muscle itself. And I see no reason for doubting that the various internal organs of the animal body are constructed for the performance of a special and peculiar office, and possess within themselves their specific properties, altogether independently of nervous agency; and I am further of opinion, that when we shall be as able to separate the nerve agency from the internal organs, as we are to part it from the muscles, we shall be equally suc-

* of the gentlemen who attended my class last summer may perhaps recollect this nt. It was performed on the dog with an artificial gastric fistula.

cessful in calling their functions into action, by the direct application of electricity, or any other stimulus, to the tissue of the organs themselves. Professor Bernard seems to take a similar view of the subject, for, speaking of my experiments, he observes that the stimulants may have acted immediately on the tissue of the liver.*

There is certainly another, and apparently a more simple, mode of explaining the influence of the stimulants injected into the portal circulation upon the glucogenic function of the liver, and one which will, moreover, be more readily acceded to, because it does not oppose any of our old views regarding the specific properties of organs or of nerves. The stimulants may act by exciting the hepatic branches of the pneumogastric nerve to transmit an impression to the nervous centre, to be from thence reflected to the liver through the splanchnic nerves, and cause an increased secretion of saccharine matter; and if this be the correct explanation of their mode of action, the normal secretion of sugar is very probably caused by the stimulating effect of the nutritive materials in the portal blood. In those cases where the vena portæ is either accidentally or intentionally obliterated, the nutritive materials absorbed by the mesenteric veins will take a circuitous course towards the liver, and in that case the blood of the hepatic artery will excite the secretion of sugar. The following facts materially strengthen the view of the normal secretion of sugar being the result of a stimulus applied to the hepatic branches of the pneumogastric nerve.

During the time of digestion, the blood of the vena portæ must of necessity prove most stimulating, as it is then loaded with nutritive materials; and this happens to be exactly the period at which the greatest quantity of sugar is formed. On the other hand, the blood of the portal vein of a fasting animal contains very little nutritive material; it is therefore but feebly stimulant, and consequently during this period the secretion of sugar ought to be lessened. This, in fact, is exactly what occurs, for in a fasting animal the secretion of sugar has invariably been found to be at its minimum.

M. Bernard has pointed out that the liver of a dog nourished entirely on fat does not secrete more sugar than if the animal had received no food at all; and this is precisely what might be *à priori* expected if the above theory be correct. For in consequence of the fats, which are scarcely if at all stimulating, being absorbed by the lacteals, and entering the general circulation by the thoracic duct, without passing through the vena portæ and liver, the blood of the portal vein of a dog nourished exclusively on fat does not contain more nutritive material than that of a fasting one.† It cannot, therefore, be more stimulating in the one case than in the other, and consequently the production of sugar ought in both cases to be at the minimum. This agrees perfectly with the facts already cited.

These data show that the foregoing hypothesis of the reflex action,

* See Leçons de Physiologie Expérimentale, par M. C. Bernard, vol. i. pp. 346, 347.

† It may be asked, perhaps, "whether the blood of the hepatic artery would not in this case, as in that of obliteration of the portal vein, excite the saccharine secretion?" It is not very probable that it would do so: firstly, because the quantity of fats in the blood is very limited; and, secondly, on account of their feebly stimulating properties.

which normally produces the secretion of sugar, is not based on illogical grounds. There exists, indeed, but one argument against the theory—namely, that while section of the pneumogastric nerves in the neck at once arrests the secretion of sugar, division of the same nerves below the point at which they send branches to the lungs is not followed by a similar result. This, too, is the very fact upon which Bernard founds his theory of the reflex action originating in the lungs. And upon a cursory view of the subject, it might be considered equally valid as an objection to the former, and as a commendation to the latter hypothesis. If we examine the point of argument, however, we shall find that the mere fact of the disappearance of sugar from the liver after section of the cervical, and not after division of the thoracic pneumongastrics, is in reality of little value, since it can be readily accounted for on other grounds. The liver ceases to secrete sugar in all cases where animals are subjected to severe operations,* whether of the pneumogastric or of any other nerve. Indeed, whenever a febrile state of the system is set up, the glucogenic function of the liver becomes immediately disturbed; section of the cervical pneumogastrics is moreover one of the severest operations to which an animal can be subjected: it is not, therefore, in the least degree surprising, that the saccharine secretion should be arrested. The same thing occurs after a variety of severe operations on different parts of the body, entirely unconnected with the nerves supplying the liver. Besides this, the slow asphyxia to which animals with divided cervical pneumogastrics are subjected, is sufficient of itself to account for the disappearance of sugar from the liver.†

On the other hand, since division of the pneumogastric nerves below the lungs in general entails neither the death of the animal, nor gives rise to any symptoms of asphyxia, it is not in the least surprising that the glucogenic function of the liver should in that case suffer but a slight derangement. Another fact in favour of the statement, that the disappearance of the sugar from the liver after section of the cervical pneumogastrics is simply dependent upon the severity of the operation, is to be found in the observation that an equal amount of injury done to the pneumogastric below the lungs is followed by a similar result. If, for example, the nerves are ligatured instead of divided, the animals frequently die, and in those cases no sugar is found in the liver. On examining the livers of two dogs, one of which died within sixteen, the other within twenty hours after ligature of the pneumogastrics at their entrance into the abdomen, I found that the saccharine secretion had been arrested, just as happens when the pneumogastrics are divided in the neck, and probably from an identical cause, the severity of the operation.

Thus it is seen that there really exists no valid objection to the idea of the glucogenic function of the liver being excited by means of a reflex action originating in the hepatic organ. On the other hand,

* See some interesting remarks upon this point at p. 360 of Bernard's Lectures.

† In proof of this statement I need but quote a single sentence from Bernard's Lectures. He says, "Si encore on asphyxie un animal lentement, les angoisses de l'agonie font encore disparaître le sucre." (vol. i. p. 360.)

there is a very important objection to the view of its originating in the lungs. For, as has already been observed, the air entering the lungs must present the same amount of stimulating action throughout the whole day; and yet the result of that supposed action is found to vary at different times.

If, then, we are unprepared to relinquish entirely the idea of the intervention of nerve agency, and to suppose that the portal blood excites the secretion of sugar by a direct stimulating action upon the tissue of the liver, we must, in absence of a better explanation of the fact, adopt the opinion that the glucogenic function in a healthy animal, under ordinary circumstances, is called forth by the stimulating action of the portal blood upon the hepatic branches of the pneumogastric nerves.

Since we now know that stimulants introduced into the portal circulation excite a flow of saccharine urine, we can easily understand how the excessive use of alcoholic drink may produce diabetes mellitus in individuals predisposed to the disease. The same fact explains to us how a disordered digestion is not unfrequently followed by saccharine urine. I may here relate a curious fact in illustration of the truth of the latter remark. About five years ago, at a time when I was much occupied in studying the physiology of diabetes, I regularly tested my urine twice a day, and on one occasion I found it to contain a small quantity of sugar. On the day in question I had partaken freely of asparagus salad; and thinking that this might perhaps be the cause of the presence of sugar, I determined to try the effects of a greater quantity. The following day, the sugar having entirely disappeared from the urine, I again partook of the same salad both in the morning and afternoon. In the evening, on testing the urine, I found very distinct indications of sugar. As the observation was to me one of great interest, I determined to make some further experiments on the subject, in order to discover how many hours this state of saccharine urine would continue. During two days I ate large quantities of the asparagus salad, taking care to have it made as stimulating as possible with vinegar and pepper. The result was far beyond my expectations; for instead of the sugar disappearing from the urine in a few hours after I had ceased partaking of the diet in question, it continued to be secreted during several days, until I at last became very much alarmed, lest the disease had been permanently induced. On the evening of the fourth day the sugar had almost entirely disappeared; but on the fifth it returned in increased quantity—so much so, that a drop of urine falling on the boot left a distinct white spot. I could not account for the recurrence of the disease, as I had been particularly careful in my diet during the two previous days.

I have mentioned this experiment, because it appears to me that if a flow of saccharine urine be induced in a healthy person, as I consider myself to be, by disordering the digestion and over-exciting the liver, it is very probable that a cause insignificant in itself, but operating upon a predisposed constitution, might tend to produce the disease. Sugar in the urine has been found after eating cheese and other indigestible substances. It is worthy of remark, that Dr. Jessen, of

Dorpat, has rendered horses diabetic by feeding them with hay damaged by moisture. M. Leconte has also found sugar in the urine of dogs after he had administered to them the nitrate of uranium. Several other substances have the same effect, and I have no doubt but that a great number more stimulants will be afterwards found to produce similar results. I cannot refrain from mentioning with what pleasure I perused a communication of M. Bernard's, entitled, On the Influence of Alcohol and Ether on the Secretions of the Digestive Canal, of the Pancreas, and of the Liver, read before the Société de Biologie.* M. Bernard, instead of putting the alcohol and ether, as I had done, directly into the portal vein, introduced them, by means of a long œsophagus tube, into the duodenum of dogs, and allowed them to be absorbed through the walls of the intestine into the portal circulation. The result, as might *à priori* have been anticipated, was identical with what I had previously obtained. M. Bernard, in fact, found that six cubic centimètres of alcohol mixed with an equal amount of water was sufficient to excite the liver to secrete a large quantity of sugar, even while the animal was fasting. With ether employed in a similar manner, he obtained no less successful results. It would be very interesting and important to ascertain if the simple introduction of alcohol into the stomach would produce the same effect. It is possible that in some cases it might fail to do so, on account of its being so acted upon by the gastric juice that it had lost its stimulating properties before it reached the portal circulation. The experiment is, however, one worth making, as in many works on diabetes, drunkards are said to be peculiarly liable to the disease.†

Having thus briefly considered some of the more important facts connected with the exciting cause of the glucogenic function of the liver, I shall conclude with a few remarks on the destruction of the sugar in the animal economy.

In the early part of last year, M. Chauveau communicated to the French Academy a very interesting memoir upon the destruction of sugar in the animal body. His experiments, which seem to have been most carefully executed, were made on the blood drawn from the arteries and corresponding veins of horses, donkeys, and dogs. And from the results which he obtained he concludes—firstly, that the sugar is not destroyed in any appreciable quantity during its passage through the lungs; and, secondly, that a certain amount of saccharine matter disappears in its passage through the capillaries of the general circulation. I have repeated M. Chauveau's experiments on the dog, and have made some others on the cat, and the results obtained are confirmatory of the conclusions arrived at by that gentleman.

The result of the following experiment upon a dog shows that the blood loses very little of its sugar during its passage through the lungs. In order to obtain the blood from the right side of the heart, I followed the method adopted by Messrs. Bernard and Chauveau. The external jugular vein on the right side of the neck was separated for

* Gazette Médicale de Paris, Mai 10, 1856.

† Some interesting remarks upon the effects of diet are to be found in Dr. Garrod's Gulstonian Lectures. See British Medical Journal, April 18th, 1857.

about an inch in extent from the neighbouring tissues, and a ligature placed on the vessel as high up as possible, to prevent the return of the blood from the head through this channel. An opening was then made in the vein immediately below the ligature, and a flexible catheter passed through it down into the right auricle. A portion of venous blood was now withdrawn from the heart by means of a syringe attached to the free end of the catheter. This blood of course contained the saccharine matter which had been poured out by the liver into the inferior vena cava. The blood from the left side of the heart was readily obtained by puncturing the carotid artery.

The manner in which I determined the amount of sugar in these portions of blood was the following: A quantity of distilled water, equal to four times that of the blood, was boiled in a capsule. To the water, when boiling, were added a couple of drops of acetic acid, and afterwards the blood was very gradually introduced. In order that the albumen might be thoroughly coagulated, a drop or two more of the acetic acid was added, care being, however, taken to avoid an excess. When the albumen was completely coagulated, which was known by its separating and floating in the then clear liquid, it was filtered. (I think this is preferable to Bernard's method of decolorizing the blood by means of sulphate of soda, and it is equally applicable when operating on the solid tissues—the liver, for example.) The sugar in the clear filtered liquid was calculated by means of Fehling's standard solution of sulphate of copper. The blood from the right side of the heart was found to contain 0·100 per cent. of saccharine matter, while that from the left side of the heart contained 0·085 per cent. The small quantity of sugar in the blood is easily accounted for by the animals having fasted about fifteen hours previous to the withdrawal of the blood. This result shows that very little sugar had been transformed during its passage through the lungs.

In another experiment which I performed on a cat* in an exactly similar manner, I found that the blood of the right side of the heart contained 0·18 per cent. of sugar, and that from the left an exactly similar amount. In order to be certain that I had made no mistake in the determination of the sugar by the volumetric method, I carefully collected the reduced oxide of copper dried, and weighed it. The amount of precipitate from both bloods was identical, thus confirming the result obtained by the volumetric method. I may here mention that Chauveau on one occasion found more sugar in the blood after than before its passage through the lungs. I also obtained a similar result, but was fortunate enough, however, to find that it depended upon the position of the end of the catheter when withdrawing the blood from the right side of the heart. The result, therefore, is of no value, either for or against the theory of the pulmonary destruction of sugar.

Being still occupied with this subject, I refrain at present from entering more into detail, or quoting other experiments in confirmation of the conclusions drawn from the above observations.

It is almost superfluous to state that the results of these experiments

* I had no means of knowing how long this animal had fasted. On killing him after I had obtained the blood, I found the stomach empty.

fully confirm the conclusion arrived at by M. Chauveau, that the sugar is not destroyed in any appreciable quantity during its passage through the lungs. This indeed appears to me what might have been anticipated when the true nature of the pulmonary function is considered. For what are the lungs? They are not laboratories, like the stomach, but merely an aggregation of little thin sacs, whose function is purely physical; at least, in as far as respiration is concerned. The only "vital" offices which they perform are simply those required for their own development and preservation. The mere absorption of oxygen and exhalation of carbonic acid gas would perhaps go on just in the same manner if a piece of goldbeater's skin occupied the place of the lungs. We now smile at Lavoisier's idea regarding the absorbed oxygen entering into immediate combination with the free carbon supposed to exist in the lungs for the formation of carbonic acid gas, and perhaps the next generation may with equal right ridicule the present idea of the combustion or fermentation of sugar in the lungs. Formerly it was believed, too, that the bile was burned in the lungs in order to keep up the animal heat; but this theory has been laid aside since the lungs were found to be the least warm of the internal organs. The blood takes but a second or two to pass through the lungs; so that if the saccharine matter is transformed in these organs, the process of transformation must be almost instantaneous. Granting that it is so, why, we ask, does the decomposition of the sugar take place in the lungs alone? We know that the presence of oxygen is not necessary for the transformation; and even if it were, abundance of that gas is to be found in the general circulation. It has been said that the presence of fibrin is necessary for the decomposition of sugar: if it is, are the lungs the only source of fibrin, or is the fibrin circulating in the capillaries of the pulmonary organs different from that in the capillaries of the rest of the body? Chemistry has as yet failed to detect any difference; and as there is plenty of oxygen as well as fibrin in the general circulation, I can see no reason why the transformation of saccharine matter should be entirely performed in one organ of the body. If Bernard is right in saying that the whole sugar is decomposed by the lungs, there must exist in these organs a something possessing the specific property alluded to. Are there any peculiar cells in the tissue of lung which secrete a substance capable of transforming the saccharine matter? I am well aware that Verdeil discovered an acid in the pulmonary tissue, to which he gave the name of pneumic acid, and that Bernard imagined it possible that this substance might have the power of transforming the sugar in its passage through the lungs; but this was only a vague hypothesis, without any evidence to support it. Pneumic acid was not known to have the property of decomposing sugar.*

Again, it might be asked, Are there any peculiar cells in the walls of the pulmonary capillaries which have the magical power of transforming the sugar as it is rapidly carried past? Or does the blood,

* Dr. Cloetta, of Zurich, has found pneumic acid to be a product of decomposition, and composed of taurine, &c.

arriving at the lungs for the purpose of arterialization, leave the capillaries to become in any way incorporated with their tissue? No positive answer can be found to either question. Where, then, is a single proof of the destruction of saccharine matter occurring in the respiratory organs? except that Bernard found large quantities of sugar on the right, and very small quantities on the left side of the heart, and has been supported in this view by Dr. Pavy. Chauveau, on the other hand, has shown that carefully-executed experiments give an opposite result; in which opinion the conclusions drawn from my own investigations lead me entirely to coincide.

Having made these few remarks upon the probability or non-probability of the sugar being destroyed in the lungs, we now take a cursory glance at what may be called the opposite side of the question. Does the saccharine matter disappear in the capillaries of the general circulation? This question has been answered in the affirmative by M. Chauveau, who found that blood drawn from a vein contained less sugar than that taken from the corresponding artery. I may here very briefly quote one of my own experiments in confirmation of this statement. I took from the femoral artery of a middle-sized dog, four hours after he had been fed with animal food, one ounce of blood, and from the corresponding vein an exactly similar quantity. On analyzing these bloods, I found the arterial to contain 0·24 per cent., while the venous blood contained only 0·16 per cent. of saccharine matter. This fact seems to be supported by analogy, when the probable uses of sugar in the animal body are taken into consideration. We now know, for example, that all animals, from a very early period of their development in the uterus up to the time of their maturity and decay, have a sugar-generating apparatus in more or less active operation. We know that daily and hourly, so long as the liver remains in a normal condition, it is manufacturing saccharine matter from the ingesta, be they animal or vegetable. We further know that during digestion, when the blood is loaded with nutritive materials, and when, consequently, the assimilative process is looked upon as being most active, the greatest amount of sugar is thrown into the general circulation. These and similar facts clearly indicate that sugar must play an important part in the nutritive process, and almost force us to believe that, like the other nutritive materials poured into the blood, it furnishes to the different tissues and organs some of the substances necessary for their development and repair. Not only am I disinclined to admit that sugar is supplied to the body for the purpose of keeping up the animal heat, but I am even loth to believe that any individual substance is taken into the system solely for that purpose. On the contrary, the production of animal heat may be regarded as a matter of secondary importance, and simply as the necessary result of the chemical changes which occur during the metamorphosis of the tissues.

If, then, the sugar formed by the liver goes to the support of the system, it is easy to understand how it should disappear from the general circulation during its transit through the minute capillaries of the different tissues. It will, in fact, leave the bloodvessels, to be trans-

formed and incorporated in the animal fabric. On a former occasion I showed by direct experiment how some of the chemical changes by which the nutritive materials are prepared for assimilation constantly take place in the blood;[*] and it can scarcely be doubted that the saccharine matter takes part in these changes. In this way we are able to account for the disappearance of some sugar from the blood during its transit through the lungs, without being compelled to believe that the transformation depended on any peculiarity in these organs or in their contents. The theory of the disappearance of saccharine substances from the general circulation seems, as far as science has yet advanced, to be equally supported by reason and confirmed by fact; and although future research may cause physiologists to modify this opinion, we can never be blamed for having deduced it from the data which we at present possess.

Art. II.

On the Epithelium of the Air-vesicles of the Human Lung. By C. Radclyffe Hall, M.D., F.R.C.P.E., Physician to the Torquay Hospital for Consumption, &c.

In a series of papers on the pathology of pulmonary tubercle, published in former numbers of this Review,[†] I endeavoured to show cause for concluding that in such cases of chronic pulmonary consumption as do not originate with actual inflammation, fatty atrophy of the epithelium of the air-vesicles is a condition antecedent to the formation of tubercle. It would, of course, be fatal to my argument if it could be proved that in health there exists no such thing as an epithelium at all upon the walls of the air-vesicles.

In the number of this Review for October, 1855, Mr. Rainey enters at some length into the "Critical Examination of the Evidence for and against the presence of Epithelium in the Air-cells of the Human Lung," and arrives at the conclusion which he had previously held, that there is no epithelium in the air-cells. From his acknowledged reputation as an accurate microscopist, any conclusion of Mr. Rainey on such a subject carries considerable weight; and those writers who dispute the existence of the epithelium referred to, do so mainly in deference to his authority.

Before proceeding further, I owe it to Mr. Rainey to apologize to him for an unintended misrepresentation of one of his statements. In my first paper it is stated—"Blood corpuscles, seen through the walls of the capillaries, were indicated by Mr. Rainey as having possibly been mistaken for epithelial cells." What I ought to have written was—"Nuclei seen in the walls of the capillaries," &c.

Mr. Rainey's arguments against the existence of the epithelium may be summed up under the four following heads: (1.) The negation of some good anatomists. (2.) The discrepancies in the descriptions given by those who affirm the existence of an epithelium in the air-vesicles.

[*] April and Oct. 1855; and April, 1856.

[†] See a review of the Chemistry of Respiration in the last October number of this Journal.

(3.) The real explanation of the appearances which the affirmers have mistaken for epithelium. (4.) The evidence of comparative anatomy.

The first head, involving merely a question of relative authority, needs no further comment than the remark, that the positive evidence of one trustworthy observer is usually allowed to overrule the negative evidence of many.

Under the second head, Kölliker is referred to as stating that the epithelium of the air-cells is difficult to demonstrate *in situ*, but as making no allusion to the want of distinctness or completeness of its individual cells, but, on the contrary, as actually giving their admeasurement; whilst I, on the other hand, am stated to make no mention of any difficulty in finding this epithelium in the lung, but to describe its individual cells as wanting that distinctness of outline and regularity of form which characterize other epithelia. From this diversity in our descriptions, Mr. Rainey infers that "there is every reason to conclude that the epithelium mentioned by Kölliker is not the same as that described by Dr. C. Radclyffe Hall." Surely this is little more than special pleading; particularly when Dr. Thomas Williams and myself are admitted by Mr. Rainey to have described the same thing, and in the main to agree in our representation with the delineation given by Van der Kolk.

Under the third head, the appearances which Mr. Rainey considers to have been erroneously supposed by myself, and others of higher authority, to represent pavement-epithelium, are referred to (*a.*) "imperfectly developed epithelial cells from the smallest bronchial tubes, which had been detached in the process of manipulating, and had got by accident into the air-cells. This is so common an occurrence, that such corpuscles are generally found in greater or less quantities in these cells; but they have not *the most distant resemblance to pavement epithelium*, as seen in other parts of the body, *nor to the imaginary hyaline pavement-epithelium* represented in Van der Kolk's plate, and the greater part of those described by Dr. R. Hall, which in most respects agree with the latter." If they do not resemble what we have described, why suppose we have seen one thing and described another? (*b.*) Nuclei belonging to the walls of the capillaries, both those capillaries which project and *those capillaries which are so blended with the membrane of the air-vesicles as not to present a distinct outline in the uninjected state.* The italics are mine. It must be difficult to decide that the nuclei really belong to the walls of such capillaries as cannot be seen in the uninjected state. Considering the extreme minuteness and delicacy of the air-vesicles, how is it possible to conclude that such nuclei do not belong to the wall of the air-cell rather than to the wall of a capillary which is invisible until the lung has been injected? (*c.*) Oval spaces bounded by meshes of capillaries. (*d.*) The sharp threads of elastic tissue, also, have "a part in producing the confused epithelium-like appearance in the air-cells."

In support of his views, Mr. Rainey depends chiefly upon his examination of *injected* lungs. I have never been able myself to find epithelium in the air-cells of an injected lung, for the obvious reason that I

have never yet seen a specimen in which sufficiently high powers of the microscope could be employed for the purpose. In order to examine an object so fine as this epithelium is, the air-cell must be used as a translucent object, and must be very carefully prepared to be distinctive even in that condition.

Mr. Rainey speaks throughout as if one type and size only of pavement-epithelium were possible in the various structures of the body. We are not, however, tied down to any such supposition. If we find fine flattish nucleated plates lining an air-cell in a tesselated fashion, we have a right to designate them a pavement-epithelium, however greatly they may differ in size or regularity of shape from the typical pavement-epithelium elsewhere.

The arguments adduced by Mr. Rainey from comparative anatomy appear to be open to exception. For example, when Mr. Rainey states that in insects many of the tracheæ are so remarkably minute that "there can be *no room* for pavement-epithelium," there seems to be no absolute reason why an epithelium correspondingly minute might not exist. Moreover, if this be an argument against the presence in mammalia of an epithelium in the air-vesicles, it would be a still stronger analogical argument against the existence of the much larger *bronchial* epithelium, which no one disputes. But, as William Pitt is said to have remarked in reference to Butler's great work, "you may prove anything *by analogy!*"

Finding nothing in Mr. Rainey's observations to shake my conviction, founded on long-continued use of the microscope, upon the subject, I requested my friend Dr. Brittan, of Clifton, to read Mr. Rainey's paper carefully, and then to favour me by investigating the question afresh. I now publish the result of his examinations, merely adding one illustration of my own.

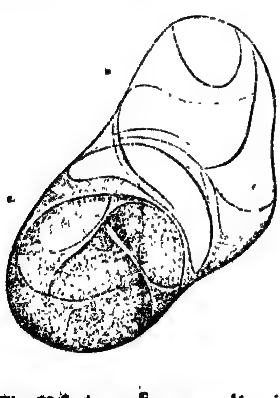


Fig. 82.* Appearances seen in air-vesicle of kitten's lung whilst yet warm and moist, previously inflated ¼ inch; this object became more indistinct in a few minutes, whilst under examination.

In examining the specimen from which the adjoining drawing was taken, the various possible sources of mistake pointed out by Mr. Rainey were severally borne in mind. I think the appearances, which I have here represented as faithfully as I was able—and Mr. Bagg, on his part, has done justice to the drawing—cannot be referred to any of them, or to anything else than the presence of a fine pavement-epithelium. The indistinctness which so soon came on, and to which Dr. Brittan afterwards alludes, was probably due merely to the drying of the specimen whilst under examination.

* The figures are numbered in continuation of those in former papers in this Review.

In assenting to my request, Dr. Brittan* stated that he had hitherto never made the point one of personal investigation, but that, so far as his impressions went, he was inclined to agree with Mr. Rainey. I proceed to quote from Dr. Brittan's subsequent communications, employing his own language, though not intended by him for publication *ipsissimis verbis :*

"1. *In a Toad.*—I did not find much ciliated epithelium; but I satisfied myself of the presence of an epithelium in the pouches, and, I thought, over the ridges likewise. There was, however, nothing very clear—nothing one could have drawn."

"2. *A Frog.*—Ciliated epithelium very evident and plentiful; epithelium everywhere evident."

"3. *Sheep.*—There were in this specimen a profusion of small entozoa, and the bit of lung seemed much altered, as if from small effusions of fibrin,—much like what you describe. I convinced myself of the presence of epithelium, however, after examining many portions."

"4. *Ox.*—A bit of fresh lung from the ox settled the point for me. When I had properly prepared the specimen, the epithelium was as plain to me as it could be; and I am satisfied none of the errors ascribed by Mr. Rainey applied here. The appearance of the cells is not analogous to that of the nuclei in the capillaries; they are to be seen all over the wall of the air-vesicles, sometimes in a continuous layer; whilst close by will be a portion of the wall without these cells, or with only a few scattered here and there still adherent. I cannot, therefore, be misled by the appearance of the fibres of the pulmonary tissue. It certainly was not bronchial epithelium, for I carefully removed a portion of the latter for comparison. I have no hesitation in saying that in this lung the vesicles were lined by epithelium. I send you a slight drawing of this specimen, in two aspects,—one focussed on the top, the other a little deeper."

1

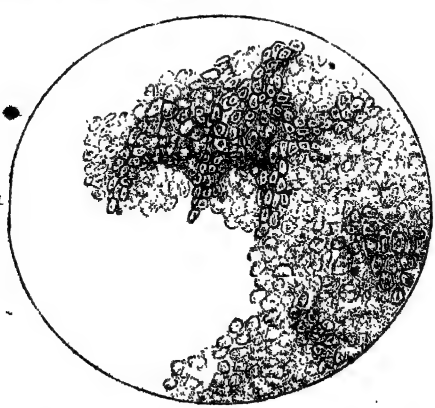
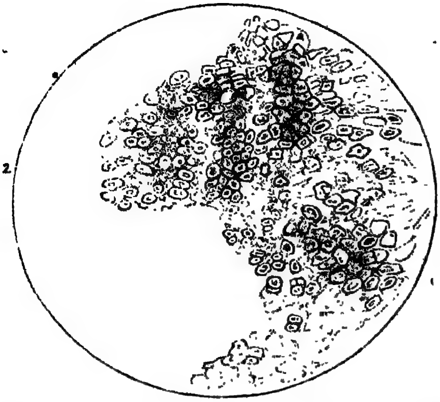


Fig. 33. From the lungs of an ox (Dr. B.). No. 1 is the same specimen as No. 2, but in different focus, showing prominently the edges of the air-vesicles.

* Physician to the Bristol Royal Infirmary, and Lecturer on the Practice of Medicine at the Bristol Medical School; formerly Lecturer on Anatomy and Physiology.

2



3

No. 3. Cells separately drawn from No. 2: these were drawn as they appeared seen by the 1-12th.

Fig. 33 2. From the lungs of an ox. No. 2 is focussed down to show the sides or floor of air-vesicles.

"5. *Sheep.*—In this specimen of sheep's lung I found the epithelium as plain as plain could be. Two or three flakes of it lying at the edge of the specimen, afforded beautiful specimens of a single layer of tesselated epithelium."

"6. *Kitten.*—I examined the lung of a kitten quite fresh, and found the same, nor did I observe the change (of early becoming indistinct) to which you refer. In fact, the specimen shows almost as well now it is put up in spirit and water as ever it did."

"7. *Human Lung.*—This specimen was not sound, being taken from an emphysematous lung from a patient who died this morning. The epithelium seems, as described, much less firm and more 'hyaline' than in any of the other specimens which I have examined. On putting up a specimen, I find only scattered cells in great quantity all round in the fluid, sometimes six or eight or more together, and a few still adhering; but on the surface of the specimen they are plainly distinguishable. I have not the slightest doubt about them, nor had Etheridge, who happened to come in; but there was nothing evident enough to be worth drawing. Of course, one would hardly expect the same condition in the lung of a patient thus diseased, as in that of an animal killed in health and vigour."

"8. *Human Lung.*—The specimens I examined from this were decisive to me. I compared them with a specimen of bronchial epithelium, and also with a bit of peritoneum with its epithelial coat still on, and I really cannot see how any one who has worked up the subject by making specimens for himself can entertain a doubt. Considering the scepticism expressed in my first letter to you, the certainty I now express is pretty strong, but so much the more trustworthy; and I am really obliged to you for having made me take up the subject and satisfy myself. I ought to have mentioned to you that I have remarked in the epithelium in question that the nucleus appears to be

always evident, but the cell-wall less clearly marked, so that you often see contiguous nuclei without being able to trace the junction of the cell-walls; the cell-walls are best seen in the detached cells that float off at the edge of the specimen."

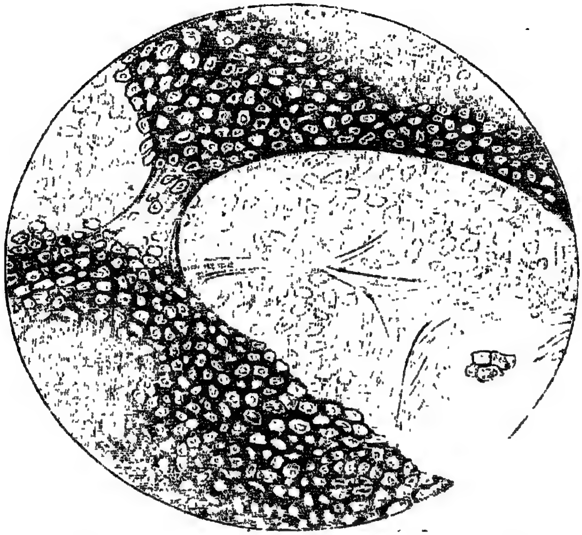


Fig. 34. Epithelium of air-vesicles in human lung. (Dr. B.)

a. Red globule, flat, and in profile. *b.* Bronchial epithelium.

"The lung of the bird I have not yet examined, for I could not obtain a bird fresh enough. However, having found the epithelium in human lung, I do not see what you want with the bird's lung."

Dr. Brittan brought the subject under the notice of the Bristol Microscopical Society—a society which includes all the leading medical men of Bristol and Clifton, and writes thus:

"As you know, it is impossible to show much to twenty men with six microscopes, especially when such minute matters are in question. I believe, however, that many were quite satisfied, and some I have promised to convince at leisure. I need not enter into further detail, but I repeat that I am assured of what I before stated—namely, that there is an epithelial lining to the air-vesicles."

To this unprejudiced testimony of Dr. Brittan, I can, of course, add

nothing. I think it will be conceded that I could not have adopted a fairer mode of attempting to settle the point in discussion. The reader has my drawings and those of Dr. Brittan before him, and can judge for himself whether the appearances (assuming the representations to be tolerably faithful) are or are not characteristic of a minute tesselated epithelium.

Art. III.

The Mechanism of the Joints of the Sacrum. By Charles H. Moore, Surgeon to the Middlesex Hospital, Lecturer on Surgical Anatomy.

The mechanical relations of the sacrum can only be entirely understood by studying all its connexions with adjoining bones. The shape of its articulating surfaces exhibits the directions in which it can move, the ligaments show from what movements it is restrained; but the connexions of the bone are so complicated, and its stability depends on circumstances so unique, that confusion still appears to rest on the minds of some anatomists with regard to it. Dr. Matthews Duncan has recently thrown much light on the subject,* though his views appear not unmixed with error. Indeed it is impossible that the anatomy of this part of the body can be completely understood, so long as the precise form and direction of the articulating surfaces, and the use of the ilio-lumbar ligaments, are disregarded or mistaken, and so long as the assertion of Cruveilhier is accepted, that the sacro-sciatic ligaments are termed ligaments "rather on account of their fasciculated shape than from their use, which scarcely has reference to the union of the bones of the pelvis."†

The inclination of the sacrum backward beneath the spinal column, causes it to present its upper articulating surface to the body of the fifth lumbar vertebra on an inclined plane downward and forward. In the erect position of the body, therefore, that vertebra tends to slide upon the sacrum; and it does so slide until its articulating processes meet those of the latter bone. The sacrum then yields to the weight, and its promontory is depressed.

With regard to the ossa innominata, the sacrum is so placed that most of the surface by which it meets the last vertebra, lies in front of its lateral articulations with the ilia, and that two-fifths of the whole length of the bone project downward and backward, below and behind the sacro-iliac synchondroses.

Such being the position of the sacrum with regard to other bones, it must be liable to two kinds of displacement. On the one hand, the innominate bones separating from one another, it might slip bodily down between them; and on the other hand, supposing it to be secured from falling between those bones, and yet articulated to them, it might yield

* Edinburgh Monthly Journal, August and September, 1855.

† Cruveilhier's Descriptive Anatomy: Library of Medicine, vol. vii. p. 302.

so much to the weight of the vertebræ as to suffer an extreme degree of inclination, and thus become an insecure basis for sustaining the spinal column. Either, then, the ligaments of the sacrum, or the form of its lateral articular surfaces, must be adapted to resist those displacements.

The wavy auricular surfaces of most sacra, whilst unfitted for extensive motion, are yet adapted to permit a certain extent of the very displacements to which the position of the bone exposes it. Narrower from side to side at its pelvic than on its spinal surface, the sacrum is liable to drop into the pelvis. It could not, however, readily do so from the inequalities of its lateral articular surfaces. Again, in the direction of movement by which the sacrum would be too much inclined, there is a curved groove, fitted by a corresponding ridge on the ilium, and extending the whole length of the articular surface, first directly downward, and then obliquely backward and downward. By the anterior part of this groove, which is in the line of the centre of gravity, the promontory may descend vertically; by the posterior part, the coccygeal end of the bone may be projected backward and slightly upward. The whole movement is one by which the inclination of the sacrum is increased, as if the bone turned upon a pivot passing transversely through it and both ilia. The imaginary pivot would be situated above and a little behind the articulation. The principal convex portions of the sacral surfaces are a slight and short elevation of the posterior edge behind the lower part of the curved groove, and a more considerable projection of the anterior angle. The former is not a constant ridge, but when it exists, would permit the descent of the sacrum. The anterior first favours, and then resists, the inclination and depression of the bone.

All sacra are not formed precisely as has been described. In some, the pivot actually exists within the area of the joint; in others, the concavity is on the ilium instead of the sacrum. But the movements of which they are all capable will be found to vary little from those of the most common and, as it might be called, the typical shape, which is that above described.

The security of the articulations, then, depends not on the bones, but on the ligaments; and these are so situated as to be only brought into use by the displacements of the sacrum already described. It is the liability to displacement which gives the bone its greatest stability.

From the tip of either lateral costiform process of the fifth lumbar vertebra, the ilio-lumbar ligament, exceedingly strong, and about an inch in length, passes outward, backward, and a little upward, to the crest of the ilium. Its attachment to the crest is in the vertical line above the sacro-iliac synchondrosis, and marks the anterior limit of that strong beam of bone of which the hinder part of the ilium is composed, and which, under the name of cotylo-sacral beam, reaches from the posterior tuberosities of the ilium to the acetabulum, and, beyond that, to the tuber ischii.

Scarcely any ligament exists on the anterior and inferior aspect of

the synchondrosis, but behind and above it the back of the sacrum is bound to the overhanging projection of the ilia by short, numerous, and exceedingly strong vertical fibres (superior sacro-iliac).

From the posterior superior spine of the ilium, a flat and strong ligament descends vertically behind the lowest part of the synchondrosis, and is attached to the tubercles on the third and fourth vertebral segments of the sacrum (posterior sacro-iliac).

Lastly, the greater and less sacro-sciatic, originating in the ischium, and attached to the sacrum, cross from bone to bone, inward, backward, and upward, at a considerable distance below the level of the sacro-iliac joint. The shorter ligament, attached near the lower end of the sacrum, passes to the spine of the ischium almost horizontally. The use of these ligaments is as follows:

The sacrum is slung between the ilia by the short or superior sacro-iliac ligaments; but those ligaments are so placed as not to interfere with that movement of the bone, as it were upon a pivot, which its auricular surfaces are adapted to permit. The weight received on the sacrum from the spine is by these ligaments transferred to the posterior overhanging tuberosities of the ilium, from which it descends by the strong cotylo-sacral beams to the acetabula in walking, and in sitting to the tubera ischii. These ligaments answer to the pivot upon which the sacrum might be imagined to turn.

When the body of the fifth lumbar vertebra, by which the weight of the trunk reaches the sacrum, slides forward over or with the upper surface of that bone, the ilio-lumbar ligaments are tightened, and the ilia are pulled toward this vertebra and one another. But the ilia, in closing together, jam the sacrum between them, and fix it by lateral pressure with a security proportioned to the weight of the last vertebra and all it bears.

Whilst this movement is taking place at the upper part of the articulation, others may occur below. The coccygeal end of the sacrum may be tilted upward and backward in the opposite direction to the depression of the promontory, or the whole sacrum may press downward and backward in the direction of its length. The latter displacement is stopped by the vertical or posterior sacro-iliac ligaments; but so far as it does occur, it necessarily tends to separate the ilia, and consequently to tighten the ilio-lumbar ligaments: these, as we have seen, draw the crests of the ilia together.

Still, as the ilio-lumbar ligaments secure the approximation of only the upper parts of the innominata, might not the depression of the wedge-like sacrum separate the innominata below? Provision is made against such a separation, and at the same time against too great an elevation, of the coccygeal end of the sacrum, by the sacro-sciatic ligaments. Far from being useless in the mechanism of the pelvis, as Cruveilhier avers, they are most important parts of that mechanism, concurring with the ilio-lumbar ligaments to jam the sacrum between the ossa innominata, and at the same time, in the reverse direction, restraining the tilting of the sacrum. The same weight which depresses the fifth lumbar vertebra and the promontory, and tightens

the ilio-lumbar ligaments, also elevates the coccyx and tightens the sacro-sciatic ligaments. The greater the weight, therefore, the tighter will be the ilio-lumbar and sacro-sciatic ligaments, and consequently the more securely will the sacrum be fixed. Moreover, it will be seen that the sacro-sciatic ligaments, by the same mechanism, become important ligaments of the spine, since they support the column in its last curvature, and render the sacrum a firm basis upon which the vertebral bodies may be safely piled.

The foregoing explanations relate to the mechanism of the sacrum only as it is a part of the spinal column, and in its connexion with both the innominate bones at once. It remains to consider the mode in which the weight of the trunk is conveyed from the top of the sacrum to either femur singly. It might be the case that the pelvic circle of bones would act as a whole, and bear in all its parts the weight which arrives only on the sacrum. In that case the weight would be divided between the two innominata, and the whole mechanism already described would come into action equally when we stand on one leg or on both. But it is probable that only the hinder and stronger portion of the pelvis is really concerned in progression. A boy who had been crushed between a dray and a wall, walked into the surgery of the Middlesex Hospital scarcely lame; yet after death he was found to have had the pubes and ischial rami of both sides broken off from the back of the pelvis. A specimen is preserved in the museum of the same hospital, in which also the anterior part of the pelvis is broken off from the posterior, yet the man had walked with only a moderate limp. The weight in such cases must have descended from the vertebræ to either femur through the ilium of its own side alone. Dr. Matthews Duncan has satisfactorily shown that the weight in descending thus to one side does not pass through the sacro-iliac synchondrosis. It is conveyed by the superior sacro-iliac ligaments to the tuberosities of the ilium, which overhang the back of the sacrum, and then descends to the acetabulum through the thick beam of bone which composes the posterior part of the ilium.

A misapprehension as to the direction of this beam—the cotylo-sacral beam—of bone, has led Dr. Duncan into what I conceive to be an error with regard to the development of the pelvis, and the cause of a part of the deformity in Nägele's oblique pelvis. He describes this beam as curved outwards between its upper extremity, at which the superior sacro-iliac ligaments pull upon it, and its lower end, which rests on the head of the femur; and he attributes its curvature to the outward pressure of the sacrum between these two points—namely, at the sacro-iliac synchondrosis. But it is surely erroneous to say that bones depend upon pressure for their regular development. Undue pressure may deform them, but not that which they are made to resist: had they no power of growing into a definite shape, and maintaining it, they would be incapable of bearing the very forces to which they are ordinarily subject. Moreover, Dr. Duncan's explanation is misapplied. The cotylo-sacral beams are not curved at all. From their extremities at the tuberosities of the ilium to the acetabulum, although not

vertical, they are straight. They have an appearance of curvature from their forming a part of the curved brim of the pelvis. But, in fact, they spread out below into the higher part of the broad acetabula, and acquire, as they spread, a concavity on their external as well as on their internal side, not a convexity, as would be the case if they were curved in the manner described by Dr. Duncan.

The converse of this principle is, with equal error, applied by the same author in the explanation of the deformity of the oblique pelvis described by Nägele. The sacro-iliac synchondrosis is obliterated in that form of pelvis, the innominatum is considerably bent between the anchylosed part and the acetabulum, whilst from the bent portion to the symphysis pubis, the bone is not curved, as in the brim of the natural pelvis, but straight. Dr. Duncan attributes the want of curvature of the linea arcuata to the want of the outward pressure of the sacrum at the points of its attachment against the innominatum. It is indeed true that the sacrum no longer exerts an outward pressure against the cotylo-sacral beam, for as the joint is anchylosed, the ligaments and the posterior iliac tuberosities are useless; but it is not correct to describe the innominatum as straight. In that part which should be straight, according to the reasoning of Dr. Duncan—viz., the cotylo-sacral beam—the bone is in fact unnaturally curved, and the straight part is the anterior portion of the brim, which could not be affected by any lateral pressure of the sacrum. The theory of the effects of outward pressure therefore falls to the ground. First, its alleged effects cannot reasonably be expected, and next, the very opposite take place. For where the joint and the pressure exist, the cotylo-sacral beam is straight, and when neither exists, that beam is curved.

The deformity of the brim in Nägele's pelvis probably occurs in the following manner. The anchylosis renders useless all the articular ligaments and the posterior iliac tuberosities. The weight of the vertebræ, therefore, no longer passes from the sacrum to the femur by the superior sacro-iliac ligaments and the cotylo-sacral beam, but directly through the anchylosed joint; that is to say, from the upper to the lower extremity of a single and much-curved bone. Such a bone necessarily bends still more, and the increase of its curvature occurs about its middle, which is just external to the anchylosed joint. The only flattening which takes place is between the abrupt curvature of the cotylo-sacral beam and the pubes, and is due to the pressure of the bone itself against the top of the femur.

Art. IV.

On Secondary Deposits and Mortification from Disease of the Arteries. By Henry Lee, Surgeon to King's College Hospital, and to the Lock Hospital.

As in some of the lower animals it may be shown that different segments possess independent vitality, so in the higher may it be as

clearly demonstrated that every part has a life of its own; and that this life is capable of being maintained for a time independent of the rest of the system with which it is naturally associated. A portion of blood, for instance, may be taken from an animal, and after remaining separate for a short time, may be again infused, so as to remain part of the living organism. Teeth, it is well known, have been transplanted in a similar way, as have also other parts of animal bodies. Such experiments clearly prove that although incapable of continued independent existence, each part may live, when separated from the rest, for a given time. Union implies reciprocal action; a dead part cannot unite with a living part. A tooth, therefore, which in its new relations shall adhere and grow, must have maintained its life when separated from its original bed; or a testicle removed from one animal, and placed in the peritoneal cavity of another, must in like manner, before it could have formed new adhesions and relations, have maintained for a time its own independent life. Mutual interchange of elements is essential to the continuance of existence. If a part cease either to receive, for any length of time, supplies from other parts, or to give off from the body, or back into the system, those elements which are redundant, it dies. The means by which this mutual interchange is effected in all the higher animals, is the circulation of the blood. The circulation, then, may be regarded as diffusing life through animal bodies; and the flowing blood may be looked upon as the life-sustaining stream of the various organs of which those bodies are composed. But as the bloodvessels are the means of conveying a life-diffusing energy to every part of the body, so may they be the means of carrying deadly influences. The stream which naturally is intended to support life, may itself contain the elements of death. The fatal influence may spread from the central and more vital organs to distant parts, or it may be communicated from any remote part to the centre, and thence again to the whole system.

The causes which induce separation, stagnation, and ultimate death of portions of the blood while in the living vessels, may therefore, as far as these affections present themselves to the surgeon, be divided into three classes—namely, 1st. Those which depend upon morbid deposit in the coats of the vessels, and subsequent discharge of that deposit into the current of the blood. 2nd. Those which originate in a division of all the coats of a vessel, either from injury or ulceration, and the admission of diseased secretion from surrounding parts. 3rd. Those which originate in some morbid action in the blood itself. In the first of these divisions may be included diseases affecting principally the arteries, and in which the *materies morbi* is carried from the centre of the circulation towards the circumference. In the second may be considered diseases of the veins, in which the morbid products are, on the contrary, carried, in the first instance, from the more distant parts of the body towards the more central and vital organs. The third division is alike common to arteries and veins, and to the structure of organs which intervene between their terminal branches.

Magendie,* from the experiments which he performed, was induced to believe that fluids introduced into the arteries of animals returned quickly through the corresponding veins, and that this occurred even more rapidly in the living than in the dead body. The experiments of M. Gaspard, however, show that while some fluids pass readily from the arterial to the venous system, others do so with much difficulty or only after the lapse of a certain time; and it is probable that there may be others, again, which cannot do so at all without previously undergoing certain changes. Some clear fluids—such as solution of tartar emetic, of opium, and of nux vomica, when introduced into an artery, pass readily in the course of the circulation, and produce their full effect upon the constitution. In such cases, where the passage of the morbid matter is not opposed, little or no irritation is manifested in the organs through which they first pass. The first of the above-named poisons produces vomiting and purging, the second stupor, and the third tetanic rigidity, when injected into an artery, exactly in the same manner as if introduced into the stomach, or injected into a vein; but no great pain or loss of power is experienced in the limb upon which the experiment is made. On the other hand, M. Gaspard found that when introduced into an artery, the infusion of tobacco neither produced vomiting nor purging; the solution of acetate of lead did not act upon the intestines, and putrid fluids did not produce those copious alvine evacuations which commonly follow the introduction of the same fluids into a serous cavity, or into the veins. The injection of acetate of lead, however, produced the signs of local inflammation in those parts to which the artery was distributed; the muscles which it supplied became of the reddish-black colour, and the whole limb had the appearance of having been affected with gangrenous inflammation. The introduction of tartar emetic, in the same way, produced slight local symptoms, but was followed by diarrhœa and fatal vomiting. Experiments like these clearly indicate that some extraneous substances when introduced into the blood, expend their action by producing a local, although perhaps most severe, disease; while others which circulate more freely with the blood, leave no trace of irritation in the first system of vessels through which they pass, but expend their influence upon some part to which their action is peculiarly determined, or produce a constitutional affection.

Changes of various kinds are found after death in the coats of arteries. These consist chiefly of steatomatous or atheromatous deposit, and of cartilaginous or bony thickening. These changes consist essentially in an alteration of the nutrition of the part, and may give rise to inflammation, as a secondary effect, in the coats of the arteries.† Two principal forms of atheroma may be distinguished; one consists of a gelatinous deposit on the internal surface of the vessel, the other of yellow spots either on the surface of the internal membrane, or in

* Précis Elémentaire de Physiologie, tom. ii. p. 389.

† The description of the morbid changes which the coats of arteries undergo is taken from Lebert's Anatomie Pathologique, pp. 512–13.

its substance. The first is originally semi-transparent, grey, or reddish. It becomes subsequently opaque and white, and connected with the lining membrane. The structure of this deposit is generally amorphous and fibroid. After a time, these patches become drier, more opaque, and may assume a reticular appearance. The second form of atheromatous deposit is by far the most common. It consists of irregular patches deposited in the substance of the internal membrane or beneath it. These patches by degrees become thicker, and may extend to the middle coat, the circular fibres of which may become softened and more or less altered in structure. Subsequently these spots may become either hardened or softened, and these conditions may co-exist, at the same time that there is the gelatinous deposit on the surface of the lining membrane. The pultaceous softening of the atheromatous disease commences in a small spot, and raises the internal membrane in a pustular form. This appearance has often been mistaken for an abscess. Under the microscope this softened matter is found of a yellowish-white colour, containing molecular granules, vesicles, or granules of fat, crystals of cholesterine, calcareous granules, and *débris* of the elements of the middle coat. The internal membrane, instead of being raised in a pustular form, is often eroded and worn away. A crack is thus first formed, then an erosion, and finally an ulcer of greater or less depth. The atheromatous ulcers present, besides the elements above mentioned, little coagula of blood deposited on their surface. Of these the only traces that often remain are the brown or blackish stains which they leave when removed by the current of the blood.

The edges of the atheromatous ulcer are flat, uneven, thin, detached, occasionally undermined by the blood. The base is uneven, of varying depth, extending sometimes to the outer coat, which then becomes thickened. This thickening is accompanied by a certain degree of congestion.

When the morbid product is firmly adherent to the coats of the vessel, a deposit of fibrin from the blood may take place which will then temporarily unite the torn edges of the divided lining membrane, and cover the ulcerated surface. But if the atheromatous disease in the artery has undergone any great degree of softening at the time the internal coat gives way, then its more fluid parts become necessarily mingled with the blood, and carried to a greater or less distance in the course of the circulation. The same general effects may then be produced, whether these morbid deposits be poured into the circulation as now described, whether similar morbid matters be generated in the blood itself, or whether they be brought from some distant part of the vascular system. There is this important local difference, however, that when any morbid matter is generated in an artery, it will necessarily expend its first and principal influence upon the parts to which that artery is distributed. The remainder of the system may or may not then be directly affected.

Disease of the arteries has very generally been considered as a cause of mortification, and the diseased conditions have by most authors

been attributed to inflammation of the arterial coats. Earthy concretions, for instance, in the arteries of the lower extremities, since first noticed by Cowper and Naish, have been regarded as the cause of the closure of the arterial canals, and of the consequent mortification of the extremities. But, as is observed by Mr. Hodgson, "our knowledge of the power of the collateral circulation in every part of the body will not allow us to admit the obliteration of the trunks as a sufficient cause of mortification from a deficient supply of blood." Some other cause of this kind of mortification had then to be sought, and a sufficient one was thought by some writers to have been found in the theory, that if the large arteries were diseased, the small ones would be so also; while others have supposed that the want of elasticity and organic power would interfere with the due supply of blood, in a degree sufficient to account for the effects observed in gangrene. Both these suppositions are entirely devoid of proof; for although in cases of dry gangrene the arteries are often found to contain bony deposits, and the smaller arteries are also sometimes found diseased, yet are these deposits not found in those situations in which the gangrene actually takes place,—for instance, in the pulpy vascular extremities of the toes, in the lips, cheeks, or lobes of the ears. In the arteries of the size here found is there never any bony deposit detected. That gangrene is not necessarily connected with disease of the arteries, is proved by the fact that it often occurs when no such disease is suspected. And, on the other hand, M. Cruveilhier has shown* that an artery which supplies a limb may be obstructed for a very considerable distance without any mortification following. If, however, an irritating injection be thrown into such an artery, mortification may readily be produced. It is remarkable that secondary mortification seldom attacks those structures which have a scanty supply of arterial blood, but that it almost invariably shows itself first in those parts which have the largest supply of bloodvessels. The vascular cheeks and lips in children, the vascular extremities of the toes in those in advanced age, are parts very frequently affected. If a simple deficient supply of blood were the cause of mortification, in such cases we should expect to find it first developing itself in the tendons and ligaments, and we should anticipate that the cellular tissue would perish always before the skin. The reverse of all this in secondary forms of mortification ordinarily occurs. The parts in which mortification in general shows itself have in truth a wonderful power of sustaining their life with a very small supply of arterial blood, and for a short time even when separated from the body. This fact is amply illustrated by the way in which portions of skin may be actually severed from the fingers and reunited, or by the length of time that a flap of skin taken from the forehead will maintain its life when converted into an artificial nose. In a case recently under the author's care, a flap of skin was taken from the side of the chest and placed across the neck in the centre of the cicatrix of a burn. It appeared to unite favourably in its new position, when the patient suddenly got into very bad health.

* Anatomie Pathologique, vol. ii. p. 801.

The old cicatrix ulcerated, and left the portion of skin newly introduced attached by a small base, peninsulated. This portion of skin, however, remained unaffected by the ulceration, and ultimately again re-united to the skin of the old cicatrix. In such cases, the arterial impulse through the transplanted portions of skin must be very slight; and in the face of such well-known facts, the want of arterial impulse can hardly be seriously maintained as a sufficient cause in itself for mortification. When a portion of skin is frozen, it turns white; and when great heat is suddenly applied, it does the same. Strong nitric acid placed on the surface of the skin or of the mucous membrane, will leave the centre of the slough which results of a dirty white colour. In these instances, it is reasonable to imagine that there may be an actual want of blood in the affected part. In some cases of spontaneous gangrene, the same may in all probability happen. But in these latter cases, which are comparatively very few in number, some unusual obstruction to the transmission of the blood through the arteries has generally been manifest; and it may fairly be presumed, from the want of pulsation in the arteries, and from the coldness of the affected part, and other symptoms, that in these cases of mortification a deficient supply of arterial blood was a principal cause of the mortification.

In the vast majority of instances the parts affected with gangrene afford the strongest contrast to such appearances. The mortified part is commonly of a deep livid colour, evidently surcharged with blood, which it has not the power to propel. This is equally true, whether there be a mechanical cause to the return of the blood, or whether no such apparent cause exist. In either case, the deep livid congestion precedes mortification—a condition quite compatible with obstructed circulation in the affected part, but utterly inconsistent with a deficient supply of blood. But, it will be asked, do not the cases in which a ligature has been applied to an artery in cases of aneurism, show that obstruction to the flow of blood through a large artery is often followed by mortification in the limb which it supplies? To this it must be replied, that it is a remarkable fact that mortification, in such cases, has only occurred when the ligature has been placed between the aneurism and the heart, and where, consequently, any softened fibrin or other morbid products which the aneurismal sac may have contained, have had an opportunity of becoming mixed with the blood of the limb upon the distal side of the ligature, and of producing their effects upon the nutrition of the parts there situated. Upon this subject we need only observe at present, that in thirty-three cases of aneurism collected by Paul Broca,* where the ligature was placed on the distal side of the sac, no instance of mortification occurred.

Inflammation of the Arteries has, by nearly all the ablest writers, past and present, been assigned as one of the causes of mortification; and the way in which this result is produced is by them ascribed very generally to the blocking up of the arterial tubes by inflammatory effusion from their lining membrane. Tiedemann, Gendrin, Hasse, Hodgson, Travers, and many other celebrated names, may be quoted as

* Des Anévrysmes et de leur Traitement. 1856.

holding the doctrine of the obliteration of arteries by inflammatory effusion of lymph upon their lining membrane. "If an irritating injection," says M. Gendrin, "be thrown into an artery included between two ligatures, the inflammation which follows is characterized by the formation of a plastic layer, which ultimately fills up the cavity of the vessel."* This opinion was currently received, and the prevalent notion for many years was, as expressed in Mr. Travers' most valuable treatise 'On Inflammation,' that these fibrinous layers were "secreted by the capillary vessels under inflammation."

Having reason to doubt the correctness of this theory, the author entered upon some researches which led him to the conclusion, that while the lining membrane of the arteries remains entire, no inflammatory effusion of lymph can take place upon its free surface. The following experiments will illustrate this point: A dog was placed under the influence of chloroform, and the carotid artery exposed low down in the neck. A ligature was then placed upon it, and the vessel was opened on the distal side of the ligature. Several small portions of cotton wadding (as large as could be introduced into the vessel) were then saturated with a solution of sulphate of zinc, and propelled, by means of a probe, along the artery towards its distal extremity. A portion of the artery was thus left obstructed, on the one hand by the ligature, and on the other by the plugs of cotton wadding. Little blood would, it was thought, under these circumstances, find its way into the vessel. The experiment was performed on September 4th, and the animal was killed and the parts examined on the 8th. The internal and middle coats had been divided at the points where the ligature had been applied. The outer cellular coat and the surrounding parts were here much inflamed, and a large abscess had formed in the immediate neighbourhood. At the part of the vessel in which the cotton wadding had lodged, the coats of the vessel had also given way, and an abscess had formed in the surrounding tissues. The intermediate portion of the artery, over which the saturated cotton wadding had passed, had become considerably retracted, so as to occupy perhaps not more than half its natural length. The lining membrane in this portion of the artery was entire, and of its natural colour. On its surface was a very small coagulum of blood, and at another point a very slight thickening or elevation of the lining membrane. With these exceptions, the inner surface of the vessel presented its natural appearance. The contact of the cotton wadding soaked in the solution of sulphate of zinc had therefore not produced any appearance of inflammation, or of effusion, in those parts over which it had passed, but where it had not been allowed to lodge.

In like manner the left jugular vein of a donkey was exposed in two parts of its course, and two ligatures placed upon it at something less than four inches interval. After the blood had been removed, the cavity of the vein was filled with cotton wadding. The wounds in the vein and in the skin were then carefully closed with sutures. The animal was killed at the expiration of forty-four hours. The lining

* Histoire Anatomique des Inflammations. Paris, 1826.

membrane of the vein in the space included between the two ligatures was of rather a deeper colour than natural, but in no point did it present any trace of effused lymph. The outer coat of the vein was thickened and inflamed, and suppuration had commenced in its outer cellular connexions.

The conclusions arrived at from the author's experiments and observations agree with those published by Virchow—viz., that chemical and mechanical irritants, when applied to bloodvessels, produce their effects only, as far as any inflammatory exudation is concerned, on the external and middle coats of arteries, or the outer coats of veins. That the epithelial and fibrous longitudinal coats of bloodvessels may become detached, and when once detached, a plastic layer from the outer coats may be poured into their cavities.

In thirteen experiments performed by Virchow, in which the lining membrane of arteries was irritated by various means, in none was there any plastic exudation from the surface of the lining membrane. Mortification of the lining membrane may be produced, but it necessitates the coagulation of the blood in the vessel to the extent of the lesion, and may be subsequently followed by effusion from the outer coats into the vascular canal.

Although effusion of lymph, as the result of inflammation, can be with such difficulty produced in the cavities of arteries, yet is there hardly any artery or vein in the human body that has not been found narrowed, closed, and impervious to blood. Professor Tiedemann, in his work on 'The Closure of Arteries in Disease,' has collected together a great number of instances, and these he refers to four heads—viz., 1st. To inflammation of the inner smooth coat of arteries; 2nd. To growth and morbid excrescences of the inner coat; 3rd. To deposits of solid or earthy concretions, or purulent matter between the coats; and 4th. To clots of blood, which, like plugs, close the sides of arteries. The first and second of these divisions we believe to be referrible to deposits from the blood. The lining membrane of an artery being a non-vascular structure, cannot be said to inflame, and so long as it maintains its integrity, lymph cannot be effused upon its surface. That which has been supposed, therefore, to be lymph effused as a result of inflammation, must in reality be fibrin deposited from the blood. Upon a microscopic examination of the white fibrinous plugs found in arteries, they may be found to consist of a delicately fibrillated material resembling that which constitutes ordinary fibrinous coagula, and in the meshes of this may be often seen an abundance of roundish corpuscles, unacted upon by acetic acid in the same manner as pus, but not unlike pus globules in general appearance. The fibrinous concretions also contain ordinarily numerous refractive globules, which, from their solubility in ether, are evidently fatty in their nature. These concretions may be very slightly, or not at all, adherent to the vessels in which they are found, or they may adhere with more or less firmness to the sides of the vessel, and sometimes they may become so intimately connected with the artery as to be with difficulty distinguished from it. In such instances they may resemble an

excrescence from its lining membrane. A thin, smooth, polished membrane often forms on the surface of these fibrinous masses, which is continuous with the lining of the vessel, and gives the appearance of the inner coat being continued over them. These white fibrinous deposits are found in almost every degree of consistence, and they may extend to any distance along the arterial canals. When they are detained in one of the larger arteries, they commonly adhere to one side of the vessel; but they are often carried along with the current of the circulation, and lodge in the substance of the organs to which the arteries are distributed. In some rare instances the fibrinous deposit may be traced continuously from the artery to its remotest ramifications. Thus, in an experiment performed by the author, in which some viscid pus was injected into the jugular vein, fibrinous cords were found to extend from the right side of the heart to the minutest ramifications of the pulmonary artery. In a case, mentioned by Sir B. Brodie,

"In which there was mortification of the right foot, the muscular structure of the heart was soft, thin, flaccid, and easily torn; one coronary artery was impervious, and the right iliac artery, for the extent of three inches, was impervious also, in consequence of its being completely filled by a mass of firmly coagulated blood. In another case, in which there had been mortification of the right foot, the muscular structure of the heart was pale and flaccid; one coronary artery was contracted and impervious; the cavities were dilated; a mass of dense coagulum, resembling that found in the sac of an aneurism, occupied the appendix of the left auricle, and there was a similar coagulum obstructing the popliteal artery and vein of the right side, and extending some way down the branches of those vessels in the leg."

Now, Mr. Gulliver has shown that the deposit which constitutes the most ordinary form of disease of the arteries is a fatty degeneration or deposit. This deposit, when it occurs in arteries, becomes softened down, causes a rupture of the thin, brittle, internal coat, and either becomes covered with fibrin, or is discharged into the blood. If covered with fibrin, this may remain firm, or it may itself become softened down, and finds its way into the circulation. In old aneurismal sacs such portions of fibrin may be found softened, and containing globules of various sizes, some not unlike pus, but unacted upon in the same way by acetic acid.

"Case I.—On the 14th of December last, a girl seven years of age was examined, after death, at St. George's Hospital. She had long suffered from anomalous symptoms, which were not referrible to any one origin in particular. On inspecting the heart, two aneurismal dilatations were found communicating with the left ventricle by very narrow openings. The aneurismal dilatations contained fibrin which had undergone the process of softening in various degrees, and it was evident that at each contraction of the heart some of the contents of these dilatations would be impelled into the general circulation. The kidney and the spleen both contained fibrinous deposits. Around these the structure of the organs was softened, and the deposit itself, after being kept for a day, became softened in its centre, and dissolved. The arteries at the base of the brain contained some small isolated masses of white fibrin."

"Case II.—A woman, aged twenty-seven, died of endocarditis (so called) on the 10th of January, 1856. The mitral valve was covered with brittle masses,

which, under the microscope, were seen to consist of dense, amorphous, highly granular, yellowish-looking lumps. Portions of fibrinous concretion (emboli) were found in the fine branches of the coronary artery of the heart. These could be recognised by the naked eye, and had produced an acute yellow softening of the muscular structure. Numerous hæmorrhagic knots were found in the spleen, in which the endocardiac emboli could with great constancy be traced into the penicilli. These emboli were also found to fill some of the little arteries of the kidneys."*

"Case III.—J. F. L., a boy, aged six, apparently in previous good health, suddenly fell down, without any complaint, on the 23rd of July, 1855; his limbs were found quite relaxed, and after a short time he said it was so dark that he could not see: when taken home he spoke little, and incoherently, but his extremities were then stiff and cold. In the evening he revived, became warm, and slept. During the night he complained of pain in the left foot and great toe; the latter was found to be black at the tip. Towards morning he complained of pain in the thigh and leg of the same side. On the 24th, a cord, of the thickness of the finger, was felt from Poupart's ligament downwards, in the direction of the vessels, about one inch and a half long. This cord was tender on pressure, and the skin over it was somewhat red coloured. A black gangrenous vesicle as large as a bean, in a half-moon shape, presented itself under the nail. The toe and that next to it were swollen, and there was considerable œdema up the instep. Motion in the left leg was attended with pain. Over the aorta a doubling was heard of both sounds of the heart; these sounds were propagated into the vessels of the neck. There was here also a strong venous murmur.—July 25th. The upper part of the thigh was œdematous.—28th. The œdema of the instep had disappeared.—August 1st. The œdema of the groin was gone, but large vibices occupied its situation on the thigh.—8th. The sore on the great toe was rapidly healing.—24th. The patient was dismissed. The sore on the toe was nearly healed. The reduplication of the sounds of the heart continued."†

"Case IV.—James Hunter, aged forty-four, was admitted into King's College Hospital, under the care of Dr. Todd, on the 1st of June, 1854. He had been ill for seven or eight months, and had, as post-mortem examination subsequently proved, some tubercles in the lungs, and disease of the kidneys. On the 26th of May, he had been seized for the first time with extreme dyspnœa. This symptom was so distressing that it precluded the possibility of his sleeping even for a few minutes. When admitted into the hospital he had had no sleep for four days and nights, and complained only of this, and a sense of anguish about the præcordial region. He sat up at night and laid his head upon the table, that being the only position in which, as he said, he could get any ease. On the evening of the 4th of June it was noticed that the left foot was cold and livid. On the 5th, the pulsations could be felt in the left femoral artery, but not in the corresponding dorsal artery of the foot. He died on the 8th, thirteen days after the first attack of difficulty of breathing. The body was examined fourteen hours after death. The left foot and lower half of the left leg were of a livid blue colour; upon cutting open the left ventricle of the heart, a quantity of thick, discoloured fluid flowed out. Besides this fluid, the left ventricle contained many clots of semi-solid fibrin in various stages of softening. The left common femoral artery, just above the origin of the profunda, was found to contain a dirty-white fibrinous clot, which quite filled up the canal of the vessel, but which was not in the least adherent to its inner coat. Below this the vessel contained a very little red

* Virchow's Archiv, Band ix. p. 307. † Professor Gustav von Dirben.

fluid blood, and appeared quite healthy. The popliteal artery contained a mottled coagulum an inch and a half in length, firmly adherent to the inner surface of the vessel, and completely blocking up its canal. Below this again the vessel was contracted. Its lining membrane was very red, and had attached to it shreds of fibrin. The popliteal vein at this point was obstructed by a clot, and the surrounding tissues were infiltrated and condensed. The coagulum was so firmly adherent to the lining membrane of the popliteal artery, that a stream of water allowed to fall upon it from a common jug, at the distance of from eight to twelve inches, did not in the least detach it. The preparation is preserved in the Museum of King's College."

If, then, we find, as in the foregoing cases, that fibrin deposited in the heart may undergo a process of softening, and may then be conveyed in the course of the circulation to arteries of the smallest as well as of the largest diameter, and may there lodge, producing softening of the surrounding tissues, or even mortification, what must we suppose to be the result of similar changes when they originate in the arteries themselves?

Fibrinous deposits not unfrequently form in diseased arteries, and may here, as elsewhere, undergo the process of softening. The product of this softening then, together with the *débris* of the internal coat of the artery, and the softened atheromatous deposit, are carried along the course of the circulation, until arrested in the smaller tubes, or in the actual substance of organs. Wherever they stop, other changes occur. In some cases the fibrin, still retaining some consistency, and adhering in its new bed, may become absorbed, and cause a puckering and contraction of surrounding parts. Nearly all arteries that have thus been obstructed have been found contracted after a certain time. This is so generally the case, that Professor Tiedemann, in describing this disease, has assumed for his title, *Arctation, and closure of the arteries.* In general, however, post-mortem examinations reveal that softening, accompanied by cell-development, has taken place in portions of fibrin that have been stopped in their course. When this occurs in a blood-vessel, it produces inflammation of its outer coats and neighbouring tissues; when in the structure of organs, it is accompanied by softening of the surrounding parts. If we find, then, as the result of disease of the arteries, that morbid materials find their way into the blood, and produce a separation of fibro-albuminous deposits which in their ulterior changes are liable to poison the different organs to which they are conveyed in the acute forms now noticed, we are led farther to inquire whether there are any chronic forms of the same affection. In cases of long-standing disease of the arteries, the products of morbid deposits between their coats, which have undergone the process of softening, must constantly pass into the circulation, as must also any portions of liquefied fibrin which have temporarily adhered to those parts where the lining membrane has given way. If the quantity of morbid deposit or of liquefied fibrin be small, it is probably disposed of without any great inconvenience, but when larger, it would appear that the contaminated blood has a tendency to lodge in the substance of the first organ to which it is conveyed. In parts where the circulation is vigorous, the impediment may probably be readily overcome, but in those parts in which the circulation is

more languid (although perhaps they may contain a large quantity of blood), there we find the injurious effects produced. Now, these are exactly the conditions in which senile gangrene ordinarily occurs. A diseased artery gradually but constantly pours the product of fatty degeneration into the blood which is conveyed to the most distant and dependant part of the circulation. The excessive pain coincides with that which experiment proves to be the result of the injection of arteries with fluids which do not readily pass into the veins. The skin, which contains the largest amount of blood, and therefore the largest quantity of the morbid material, perishes first; and in succession the cellular membrane, bone, tendon, and ligament. If this be the true pathology of dry gangrene, it explains at once how futile amputation is likely to be while the original source of disease remains in the form of fatty degeneration of the artery supplying the limb. It explains also why opium and tonics are found to agree so much better than the antiphlogistic plan formerly recommended by Dupuytren. Finally, it explains how, when the morbid material which produces the gangrene ceases to be supplied, the patient may recover, as in case No. III.

The following case, which lately came under the care of my friend Mr. Bowman, at King's College Hospital, shows the tendency there is to the formation of fibrinous deposits in those situations where the inner coat of the arteries has been removed by disease.

"Case V.—Philip Shaw, aged fifty-six, a porter, was admitted into Fisk Ward on the 4th of February, 1857, with gangrene of the left foot. On the 31st of January, after having been exposed to cold during the day, he felt in the evening some numbness and stiffness in the left foot. He subsequently experienced considerable pain, and the skin of the toes became of a dark bluish colour. When admitted into the hospital, his countenance was pinched and congested, as if from habitual intemperance. The pulse intermitted at every seven or eight beats, and there was a distinct bellows sound at the apex of the heart. In the beginning of March, the whole of the metatarsal bones had become exposed by the separation of the sloughs, and on the 23rd of the same month he died. The body was examined thirty-four hours after death. A distinct arcus senilis presented itself in each eye. On opening the chest, the lungs were found healthy, and everywhere crepitant. The cavities of the heart were empty; there was some thickening of the mitral valve; the arch of the aorta presented numerous atheromatous patches. In the abdomen the liver, spleen, kidneys, and intestines were found perfectly healthy. The aorta here presented similar deposits to those already noticed. Near the origin of the inferior mesenteric were some fibrinous flakes adhering to the posterior part of the vessel, and connected with a coagulum which extended some three or four inches down the vessel. The common and external iliac arteries on both sides were much more diseased, the atheromatous deposit here having undergone various degrees both of hardening and softening. The femoral artery of the left side was almost obstructed in its lower part by white fibrinous coagula. Between this deposit and the wall of the artery a channel appeared to have been formed, through which the blood had passed. In the popliteal space the vein and the artery had become firmly adherent, and were both obstructed. The left posterior tibial artery was almost closed by fibrinous coagula. In the anterior tibial artery no disease was discovered. The axillary, brachial, radial, and ulnar arteries on both sides

were apparently healthy. The arteries at the base of the brain showed some distinct patches of atheromatous deposit. A preparation of the arteries containing the fibrinous deposits is preserved in the museum of King's College."

The practical idea which suggests itself from the foregoing observations and cases is, that a diseased or partially obstructed artery may be more dangerous to a patient's welfare than one which is completely closed. The blood, in the case of the obliteration of the main trunk, would probably be conveyed to the extremity in diminished quantity, but flowing through collateral and comparatively undiseased channels, it would be more free from the admixture of any morbid matter which it might receive in its passage through the limb.

A greater danger may therefore arise to a limb from the principal artery being partially or temporarily obstructed, than from its complete and permanent obliteration. This point is illustrated by the following case, taken from Dr. Oldham's notes, and for which I am indebted to Mr. Birkett, of Guy's Hospital:

"Case VI.—A very tall, healthy, muscular, and robust Scotch peasant, thirty years of age, was admitted into Guy's Hospital on the 15th of August, 1856, for a popliteal aneurism. On the 17th of August a 'temporary ligature' was applied to the femoral artery. The ligature was removed at the expiration of seventy-two hours. For the next four days everything appeared satisfactory, when on the morning of the 25th of August a small dusky spot was observed by Mr. Birkett on the dorsum of the foot. This spot increased, and it was evident that mortification had commenced. During the course of the day some hæmorrhage took place from the situation of the temporary ligature. This again recurred on the following day, August 26th, when amputation of the thigh was performed."

Whether the partial and temporary obstruction to arteries by pressure in cases of aneurism is liable to be followed by any similar accidents to those attending upon the temporary ligature, experience has yet to decide. Three instances have lately come under the author's notice in which mortification of the leg followed the treatment of a popliteal aneurism by pressure. In two of these cases the femoral artery was at length tied, and before the mortification had apparently commenced.

PART FOURTH.

Chronicle of Medical Science.

HALF-YEARLY REPORT ON MATERIA MEDICA AND THERAPEUTICS.

By Robert Hunter Semple, M.D.,
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I. *On Indian Febrifuges.* By Assistant-Surgeon W. R. Cornish. (Indian Annals of Medical Science, October, 1856.)

Among the indigenous febrifuge plants of India, the margosa or neem tree has long enjoyed a considerable reputation. This tree belongs to the natural order of *Meliaceæ*, and to the genus *Azadirachta*. The important part of the margosa tree, considered as a febrifuge, is the bark, which varies in thickness from a quarter of an inch to an inch, according to the size of the tree. On making a section of the bark, the outer layer is found to be of a bright purple colour, while the inner is almost white; these separate readily from each other, the inner being the thicker of the two. If a small portion of the latter be chewed in the recent state, it has at first a sweetish taste, followed quickly by a powerful and lasting bitter. The author of the paper remarks upon the curious fact, that although the margosa bark has long been recommended as a febrifuge, yet it has hitherto been very rarely used by European practitioners in India; and he points out the necessity of searching for some cheap and efficient substitute for quinine at the present day, when the cinchona forests of South America are gradually becoming extinct. Mr. Cornish's experience of the efficacy of the margosa bark extended over a period of six months, during which time nearly all the fever patients which came under his care while he was doing duty with a native troop of Horse Artillery at Secunderabad were treated with margosa decoction. He employed an emetic in all the cases as a preliminary measure, and afterwards prescribed a decoction of the margosa bark, prepared by boiling the dried bark in water for fifteen to twenty minutes, and straining it while hot through calico. The dose was an ounce and a half to three ounces, given repeatedly before the accession of the paroxysm. The physiological action of the bark can only be described negatively. A large dose of the decoction has no immediate action upon any of the animal functions, and continued doses are borne without any inconvenience to the system. It does not appear to be a very active remedy, and it rarely cuts short a paroxysm of fever. It does not produce any disagreeable effect upon the internal economy, and under its use the tongue becomes clean, the appetite generally improves, the febrile paroxysms become milder, and are soon worn out. The neem bark is unquestionably a tonic, but it is difficult to determine whether it can be regarded as an *antiperiodic*. The author thinks that the properties of the bark depend on the presence of a bitter alkaloid principle, to which he applies the term *margosine*. This bitter principle is found in the greatest quantity in the inner bark, while the outer bark contains an astringent principle closely allied to the variety of tannin found in catechu. In addition to these principles, the bark yields an essential oil, a bitter resin, gum, starch,

and sugar in considerable quantities. The results of his experience are such as to convince Mr. Cornish that the margosa is quite as effective in the treatment of intermittent fevers as cinchona and arsenic, and he found that the per-centage of failures was even less under the margosa treatment.

Under the impression that the action of tonics and astringents is identical, Mr. Cornish has been induced to examine the effect of the latter class of medicines in the treatment of fevers, and the results have been somewhat favourable. He comes to the conclusion,—1st. That vegetable astringents may be substituted for quinine in the treatment of simple quotidian and tertian intermittent fevers. 2. That in the former, vegetable astringents will fail in from five to ten per cent. of the cases treated. 3. That in the latter, quinine has little or no advantage in breaking the febrile paroxysms or curing the patient. 4. That the double tertian intermittents do not readily yield to vegetable astringents, and in this type of fever quinine is superior. And 5. That vegetable astringents have failed in a smaller proportion of cases of all forms of fever, than the febrifuges, cinchona and arsenic. The vegetable astringents which have been tested in hospital practice have been galls, catechu, and dibi divi, or Cæsalpinia coriaria. The seed-pods of the latter plant contain a large per-centage of astringent matter, and Mr. Cornish therefore employed them in the treatment of fever. He gave the dibi divi powder to nearly one hundred patients suffering from intermittent fever in its various forms, and with considerable success. The dose of the powder-pods commonly used was from forty to sixty grains three times a day. Constipation of the bowels was a very uncommon symptom, and in two cases the dibi divi even seemed to cause diarrhœa. Cases of fever, complicated with anæmia and splenic enlargements, appeared to do best under this treatment.

The author remarks incidentally, that the amorphous quinine supplied to the Indian hospitals does not appear to possess any great advantage over some of the common native febrifuges, but that the sulphate of quinine is undoubtedly the best febrifuge in existence. He is accumulating evidence to show that the amorphous quinine is not of equal value as a febrifuge with the crystalline variety.

II. *On Chloride of Gold and Sodium, employed as a Solvent in the Treatment of certain Tumours.* By Dr. Rouault. (L'Union Médicale, Feb. 21st, 1857.)

The author of this communication relates some cases observed by Dr. Debreque and himself, in which it was found that the preparations of gold possess a special elective action in the treatment of glandular tumours. In chronic adenitis in general, and particularly in cervical adenitis, the solvent properties of the preparation alluded to appeared even more energetic and certain than those of iodine. One of the circumstances favourable to its employment is the presence of several tumours, separated or united in the form of a chaplet, or of ganglionic knots. The author remarked that its efficacy was less evident when there existed only a single ganglion, the resolution of which then only takes place with extreme slowness, and often not at all. Gold is also useful in benignant tumours of the breast, such as simple engorgement, hypertrophy, and sub-inflammatory tumours; and it also appeared to Dr. Rouault to be undoubtedly efficacious in certain tumours which were evidently of a malignant nature. The chloride of gold and sodium was the preparation generally employed, being combined with starch and gum arabic, and made into pills. With one of these pills friction was made every evening on the tongue, the gums, and the inside of the cheeks. The friction should be employed for some minutes, and the patient ought not to spit, so as to swallow any remains of the matter which is rubbed in. This plan is to be followed for at least six weeks. Several cases are related in which this plan appears to have been attended with success.

IV. *On Pepsin, and its Chemical and Physiological Properties.* (Bulletin de Thérapeutique, January, 1857.)

In an analysis of a paper read lately by M. Boudault to the Société de Pharmacie of Paris, the author, after discussing the general properties of pepsin, proceeds to make the following remarks upon that substance employed as a medicine: Its administration presents some rather considerable difficulties, in consequence of its liability to alteration when the vessel which contains it has been opened. Besides this, its origin, its viscosity, and its disagreeable smell were so many motives for disliking it on the part of the patient. It was necessary, then, to find a method of transforming it without injuring its medical action. It was to be feared, in associating it with an inert substance, that the latter would experience a kind of digestion, or would act upon the pepsin as a ferment. It was necessary, besides, that this substance should be sufficiently hygrometric to absorb the humidity of the pepsin, and not to attract, in addition, the humidity of the air. Sugar was one of the substances with which it appeared most easy to associate pepsin; but at the end of some days the cane-sugar is transformed, under its influence, into glucose, and afterwards into lactic acid, for here the pepsin acts as a true ferment. Starch dried at 100 degrees (Cent.) has given to M. Boudault the most favourable results. Starch, which has the property of not injuring the digestion, forms with pepsin a pulverulent matter, the odour of which is very weak, and the taste partly disguised. This powder is preserved very well in well-stopped bottles, and time does not modify in any way its physiological properties. Under this form, pepsin may be mixed with a number of medicinal substances which do not at all modify its therapeutic action: thus, with hydrochlorate of morphia, to relieve violent pains of the stomach; with strychnine, to stimulate the peristaltic movements of this organ; with nitrate of bismuth, lactate of iron, carbonate of iron, iodide of iron, and other similar preparations. It is very efficacious in dyspepsia, and in all cases of difficult digestion which generally follow the convalescence from serious or chronic diseases; and it has been found a powerful digestive agent in cases of consumption caused by insufficient food. Pepsin is administered in the first spoonful of soup, or even before meals, wrapped up in a wafer; and precaution must be taken not to eat immediately afterwards food which is at a higher temperature than 45 deg., for then the digestive properties of pepsin would be destroyed. It is employed in the acid or in the neutral state. In the acid state, it takes the place of the gastric juice, when the latter is not formed in sufficient quantity in certain morbid affections; in the neutral state—that is to say, feebly acidulated—in cases where the stomach contains too great a quantity of acid. It may be shown that chemical or artificial pepsin may very well take the place of the gastric juice, and may be considered among one of our most heroic remedies.

III. *On the Preparation and Therapeutical Employment of Subcarbonate of Bismuth.* (Bulletin de Thérapeutique, February 15th, 1857.)

The following is the mode of preparation of the subcarbonate of bismuth described by M. Hannon, Professor at the University of Brussels. The bismuth is first purified by melting this metal in powder with ten times its weight of powdered nitre. After cooling, the metal is again powdered, and mixed with ten times its weight of nitre, and after a second fusion the bismuth may be considered as entirely free from the arseniurets and sulphurets which it almost always contains. Then three parts of nitric acid are put into a retort, and one part of pure bismuth is added. When the reaction is complete, about a third of the liquid is evaporated, then the solution is poured drop by drop into a

solution of carbonate of soda; and a white precipitate is obtained, which is subcarbonate of bismuth. The precipitate, after having been washed five or six times with distilled water, is thrown upon a filter, and washed again to remove the last traces of carbonate of soda. It should be preserved in well-stopped bottles. The physiological properties of the salts of bismuth are very little known, for the simple reason that the subnitrate is the only salt which has been employed in medicine. The operation even of this salt is not well understood, as its insolubility offers an obstacle to the observation of the physiological phenomena which might have been observed in the other salts of bismuth, such as the citrate, the tartrate, the acetate, or the carbonate. It is also the insolubility of the subnitrate which renders it inefficient in the greater part of the cases in which it is indicated; and it also occasionally produces a very inconvenient sensation of weight at the stomach. The subcarbonate is soluble in the gastric juice, its action is rapid, it produces no sensation of weight at the stomach, it rarely constipates, colours the stools less than the subnitrate, and may be employed for a long time without oppressing the stomach. The action of the subcarbonate appears to be sedative during the first days of its employment, and subsequently to excite all the phenomena which result from the action of tonics.

As to its therapeutical action, it may be noted that all cases of gastralgia consecutive upon phlegmasia of the digestive passages, cases in which the tongue is red and pointed, and cases in which the digestion is laborious and accompanied with putrid or acid eructations, or in which there is a tendency to diarrhœa or spasmodic vomiting, demand the employment of the subcarbonate of bismuth. This salt is also required in the vomiting of children, whether caused by dentition or succeeding to frequent fits of indigestion, and in the diarrhœa of weak children, especially when occurring at the time of weaning. One great advantage possessed by the subcarbonate of bismuth is, that it neutralizes the acids in excess which are found in the stomach. The subnitrate, as is well known, fails always in this respect. In all the cases where the subcarbonate has been taken, the pain in the digestive passages is first found to disappear; then the eructations cease, together with the vomiting or diarrhœa; the digestion becomes less and less laborious, the tongue gradually receives its normal form and colour; and if the use of the subcarbonate is continued, the appetite increases from day to day, the yellow tint of the countenance disappears, and the face becomes coloured at the same time as it ceases to be shrivelled.

The subcarbonate of bismuth is perfectly insipid, and excites no repugnance. It is given before meals. Adults take it in a little water, and children in honey. It may also be made into lozenges. The dose for adults is from one to three grammes, taken three times a day, in increasing doses.

V. *On the Curative Properties of Sulphureous, Ferruginous, and Alkaline Springs.* (L'Union Médicale, April 4th, 1857.)

In a late discussion at the Société d'Hydrologie Médicale of Paris, M. Cahen discussed the question, whether sulphureous, ferruginous, and alkaline springs possess any other curative properties besides those possessed by sulphur, iron, and bicarbonate of soda; and he comes to the conclusion that the benefit arising from the use of such waters is of a strictly physiological and chemical nature, and is due to the presence of the mineral which is held in solution. It is true that there are accessory circumstances which are not to be neglected in considering the effects of mineral waters in the restoration of health,—such as the journey—the change of air, of diet, and of habits—the influence of amusement, and even of hope; but these are not in themselves,

except in special cases, sufficient for effecting a cure. In explaining the influence of mineral waters, however, an exclusively chemical view of their character is to be deprecated; for the human system in contact with such waters cannot be regarded in the same light as a chemical experiment made in the laboratory, where the conditions of the experiment are fixed and constant. Thus the Vichy waters, acting upon the mucous membrane of the stomach affected with pyrosis, attended with hypersecretion of alkaline matters, are not to be regarded as an alkaline fluid saturating an excess of alkali; for physiology has shown that in contact with a small quantity of alkaline water, the mucous membrane of the stomach secretes abundantly *acid gastric juice*, and it is this acid gastric juice which removes the inconveniences of an abnormal secretion. The water acts only mediately in this case, by the reaction which it has excited. It has also been said, that while mineral alkaline substances introduced in excess into the economy produce an alkaline cachexia, yet gouty persons drink every day and for a long time enormous quantities of Vichy water without the slightest inconvenience. Now this happens *because they are gouty*, and because there exists in them an acid diathesis which opposes the influence of alkaline drinks. M. Cahen concludes his observations by remarking that, in his opinion, there is nothing latent or mysterious in the action of these waters, and that they act, on the one hand, in a physiological manner, and, on the other hand, by virtue of the mineral substances which they contain. In the course of the discussion which followed the remarks of M. Cahen, M. Durand-Fardel denied the accusation sometimes brought against the Vichy waters, that they had often induced an alkaline cachexia; and he stated that he had himself lived at Vichy ten years, and had seen a great number of persons take the mineral waters in excess, and suffer inconvenience from so doing, but had never observed anything approaching to what has been described as alkaline cachexia. M. Cahen, on the other hand, although admitting that gouty persons are with difficulty rendered cachectic by the use of the Vichy waters, contended that this cachexia did really exist. He himself had employed immediately the waters and the baths of Vichy, and he fell into a distinctly asthenic state; his blood, drawn from a vein, presented a defibrinated appearance. He also stated that the inhabitants of Vichy are of squalid appearance, which circumstance may be attributed to their habit of using the waters in their daily occupations.

VI. *Balneological Sketches.* By Prof. LÖSCHNER, of Prague. (Vierteljahrsschrift für die Praktische Heilkunde, 1857.)

Prof. Löschner, after some remarks upon the operation of the gases introduced into the lungs by the breath during bathing, describes the operation of certain baths in the cure of disease. He treats first of the operation of the Marienbad springs in the diseases of children. It should be premised that the diet of all the patients was regulated upon a uniform scale. The Kreuzbrunnen and Ferdinandsbrunnen of Marienbad are found efficacious in scrofulous affections of the glands, of the skin, of the bones, with and without the appearance of reaction; glandular inflammation in different parts of the body, formation of abscess, caries, ulceration of the cornea, eczema, herpes, psoriasis, zoster. The operation of these waters is shown by constant increase of the functions of the intestines and kidneys, with appearance sometimes of the formation of sulphuret of iron and development of sulphuretted hydrogen, together with remarkable secretion of bile, sometimes of uric and oxalic acids, particles of fat, shreds of mucus, diminished excretion of phosphoric acid, and afterwards decrease of the weight of the body, but nevertheless increased vital activity in combination with powerful changes in the whole process of nutrition. The latter is especially shown in the vivacity of the children, which at first is

diminished, but is subsequently increased; in their better and purer colour; in the disappearance of glandular tumours (unless when they are infiltrated with tuberculous masses); in the diminished swelling of the bones; in the drying-up of chronic exanthemata; in the discontinuance of inflammatory symptoms in the eye and ear. The activity of the heart and arteries was augmented, the tympanitic condition of the abdomen subsided, the mental operations became active and lively. The mode of operation of the Marienbad springs, in accordance with their chemical peculiarities, may be stated to consist in bringing about a more active metamorphosis of tissues, acceleration of the digestion, normal conversion of the nourishing material into the organic juices, and more powerful nutrition by means of the increase and improvement of the constituents of the blood. Dr. Löschner then describes the use of the iodine water of Halle and Fracchia's sea-baths in children's cases. The diet should first be regulated, by allowing a copious supply of meat and a limited quantity of vegetables. The subjects most appropriate for treatment in these baths are those suffering from torpid scrofulous affections, and rhachitic patients with a high degree of swelling of the epiphyses; the former in the most intense form of abdominal, cutaneous, and glandular scrofula; the latter being cases of long duration, and already beginning to exhibit ossification of the swellings of the epiphyses. The author knows no mineral water containing iodine which exhibits its operation so powerfully and so quickly upon the organism as that now described; and this effect he attributes to the absorption of iodine into the system. Baths with the iodine water of Halle and the artificial sea-baths soon produce, when used continuously and in a concentrated form, powerful symptoms of reaction, and the appearances of iodism, with tumultuous and reducing metamorphosis of tissues; while baths of moderate temperature, of brief duration, employed every second day, may be continued for weeks, and even months, without producing such a tumultuous operation, and accomplish in a tranquil manner the changes of the tissues. It is remarkable and surprising, under such circumstances, to observe the disappearance of scrofulous tumours, of chronic catarrhs of the nose, throat, and genital mucous membrane depending upon a scrofulous origin, such as scrofulous ozæna and utero-vaginal catarrh; the subsidence of swellings of the epiphyses in rhachitic patients, with striking improvement of the aspect after a moderate previous excitement of the function of the skin, and the separation of abnormal quantities of mucus, with salts of uric and oxalic acid, through the respiratory and urinary organs. Dr. Löschner found the iodine waters of Halle very useful, when employed internally, and when inhaled by the nostrils, in a case of long-continued ozæna in a young woman approaching puberty, in whom for many years a great number of remedies had been employed in vain; also in glandular swellings of the abdomen; in chronic utero-vaginal catarrh, in which artificial sea-baths and the internal use of the iodine water have effected a complete cure; and in chronic exanthemata of scrofulous children, in which this water is a most powerful remedy. Latterly, Dr. Löschner has made some experiments with the iodine water of Halle in the syphilis of children, using at the same time the artificial sea-baths, if exanthemata were present at the same time. Four cases only of this kind of treatment have been observed; but they appear to the author to justify him in the belief that the operation of the water is also beneficial in these maladies.

VII. *On the Anæsthetic Action of Carbonic Oxide.* By Dr. OZANAM. (Archives Générales de Médecine, Feb. 1857.)

Dr. Ozanam considers that the results hitherto obtained by the use of anæsthetic agents concur to demonstrate the truth of the law, that the whole series

of carbonized bodies, volatile or gaseous, are endowed with anæsthetic power, and that they possess this power in proportion to the carbon which they contain. He has therefore undertaken some experiments with carbonic oxide, carbonic acid, and cyanogen, and the results observed with the first-named gas are detailed in the present memoir.

The carbonic oxide is obtained by the action of sulphuric acid, aided by heat, upon oxalic acid; when the latter is resolved into carbonic acid and carbonic oxide, and the carbonic acid is removed by lime-water, while the carbonic oxide remains in the gaseous state. The experiments and observations were thirty in number, of which twenty-five were on rabbits and five on man. The author divides the phenomena produced by the inhalation of carbonic oxide into four periods—viz., 1st. The prodromic period; 2nd. The period of excitement; 3rd. The period of anæsthesia; and 4th. Death or restoration of sensibility.

A pipe connected with a bladder filled with carbonic oxide was introduced into the mouth of a well-fed rabbit, whose nostrils were closed; an assistant pressed upon the bladder, and the animal, forced to breathe by the mouth, inhaled the gas mixed with atmospheric air. During the first five or six inspirations the animal made no effort—it was motionless and astonished, as if under the impression of a danger which it suspected but did not know, and of which it did not yet feel the violent effects. But at the end of fifteen to thirty seconds, this preliminary period was succeeded by a stage of excitement: the animal leapt and made efforts to escape; then these voluntary movements were succeeded by very strong convulsions, contractions, throwing the head backwards, trembling, &c. During this period, the circulation was accelerated at first from fifteen to twenty pulsations under the influence of the convulsive agitation; then it returned to its normal rate, which it soon quitted and became slower. The respiration, on the contrary, offered from the beginning a marked tendency to become slower. To the convulsive state suddenly succeeded the period of collapse or stupor; all movement ceased, the body fell back like an inert mass, the head hung down, the eye was widely open, the pupil dilated, the sight almost abolished, the four members were paralyzed, the urine passed involuntarily, the pulsations of the heart became more slow, the respiration also was less frequent. If the inhalations are prolonged, the respiratory act is weakened still more; it occurs only about once in five or ten seconds, by a general and jerking effort, resembling hiccough; but prolonged to this degree, the anæsthesia becomes dangerous, and it should be narrowly watched, for the inspiratory nerves are almost paralyzed, and the animal approaches the state of apparent death.

The experiments made and recorded by Dr. Ozanam prove beyond a doubt the anæsthetic action of the gas, and he regards it as more energetic in its action than chloroform, but less prolonged in its operation; its effects are rapid, violent, and transient, so that an animal may pass in a few minutes from the state of apparent death to a normal condition. On the other hand, it possesses certain advantages over chloroform, in the absence of a strong, or penetrating, or caustic smell—a circumstance which renders the gas easily respirable by every person; while ether, chloroform, and the carburets of hydrogen, have all a penetrating smell, which renders them offensive to many persons, and they are caustic when applied to the skin. It is also easily measured, owing to its permanently gaseous condition, which is not the case with chloroform and ether: their volatility varies under the slightest influence, as the summer, the heat of a room, or the vicinity of a stove, will cause a patient to absorb double the quantity of the vapours which would have been breathed if the circumstances had been different. The anæsthetic operation of carbonic oxide terminates in recovery from insensibility, or in death. When the inhalations are discontinued, the animal is abandoned to itself. During one to three minutes,

the anæsthesia remains absolute, and the animal might be considered dead, if auscultation did not still reveal the weakened sounds of the heart, and some rare inspiratory efforts. The ordinary life soon recommences, respiration is re-established, and the heart progressively resumes its normal rate, and sometimes slightly exceeds it. But occasionally the passage from stupor or apparent death to real death is sudden, unexpected, and similar in this respect to sudden death by chloroform: the heart and respiration, already very slow in their actions, cease at once and for ever.

In case of poisoning by carbonic oxide, the antidote most likely to prove serviceable is ammonia; and Dr. Ozanam details two cases of rabbits poisoned by carbonic oxide, which were restored by the application of the vapour of ammonia.

VIII. *On the Use of Amylene as an Anæsthetic Agent.* By M. Luton. (Archives Générales de Médecine, February, 1857.

After describing the properties of amylene, as recorded by Dr. Snow in some papers recently published in this country, M. Luton details the results of two experiments made in Paris upon young children with this anæsthetic. In both cases there was sudden and remarkable lachrymation, as in breathing the vapours of ammonia; and there was evident repugnance at first to the inhalation; but this soon passed away, and anæsthesia was induced. Both children rapidly recovered after the amylene was withdrawn. Admitting that the results observed in two cases only are insufficient to justify the expression of any decided opinion upon the qualities of amylene as an anæsthetic, M. Luton thinks that he may draw the following conclusions: The advantages resulting from its employment are, that its action is rapidly manifested and rapidly dissipated, owing to its great volatility; that the insensibility is sufficient, although the sleep is less deep than that induced by chloroform; and that there is less uneasiness to the patient during the course of the operation. The inconveniences of amylene are to be found in the necessity of employing a great quantity of it during the operation, and its disagreeable odour, which is so strong as to be offensive to the persons engaged in the operation, and, of course, is still more so to the patient.

IX. *On the Employment of Electricity in the Suppression of the Lacteal Secretion.* (L'Union Médicale, January 3rd, 1857.)

M. Becquerel, in a late communication to the Société Médicale des Hôpitaux de Paris, has made some remarks upon the influence of electricity in restoring the secretion of milk. His attention was called to the subject by a case related to him by M. Aubert, who had employed electricity in the case of a young woman whose milk had been suppressed in consequence of a double pneumonia. The electricity was applied to the breasts by means of moist excitors, and after four applications, each lasting twenty minutes, the lacteal secretion was completely restored. M. Becquerel was at first incredulous as to the reality of the result; but the following case, which fell under his observation, removed his doubts:

A young woman, aged twenty-seven, well formed, although of a nervous temperament, had suckled a young infant for six months, but, on the occasion of some intense and often-repeated mental emotions, the lacteal secretion diminished considerably; the right breast retained a little milk, but the left was almost completely dried up. M. Becquerel applied the electrical current at first to the left breast, placing the moist excitors, made of sponge, successively

in the different points of the circumference of the breast, so that the currents might traverse the organ in all directions. Three applications were made, each lasting a quarter of an hour. The patient suffered very little, and indeed experienced little more than a feeling of inconvenience. From the time of the first application, the rush of milk supervened almost immediately after the application of the electrical currents. After the third application, the secretion was full and entire; the child had taken the breast, and the milk was abundant in the left breast, and sufficient in the right to obviate the necessity of applying the electricity on that side.

X. *On a Case of Diabetes treated by the Use of Rennet.* By Dr. IVERSEN. (Archiv des Vereins für Gemeinschaftliche Arbeiten, 1856.)

Dr. Iversen relates the case of a patient, in the lower class of life, who had well-marked diabetes, who was treated with rennet, and the details of whose case were carefully recorded day by day. As all the usual plans of treatment had been unsuccessful before the patient's admission into the hospital under Dr. Iversen's care, he made an experiment of the rennet treatment. In order to obtain as accurate a result as possible, it was determined, in the beginning of the treatment, not to alter the diet of the patient, except to recommend the greatest possible abstinence from drinking. By the table prepared by Dr. Iversen, the treatment seems to have been successful in diminishing the quantity of sugar in the urine; but from some circumstances which are not explained, the patient was seized suddenly during the progress of the case with fainting, followed by spasms, ending in death. No post-mortem examination was permitted, and the case is therefore imperfect. Notwithstanding the unfortunate result, Dr. Iversen considers that the constant diminution of the urine, both in its actual quantity and in its saccharine ingredient, was very remarkable. He shows that in the first four days, during which the patient took no medicine, the average quantity of urine voided amounted to 10·108 cubic centimètres. In the following period of seven days, during which she took the rennet, the quantity of urine reached only 7·927 cubic centimètres, with a quantity of sugar amounting to 324 grammes. In the next five days, during which she took the rennet in combination with phosphate of soda, the average daily quantity of urine sank to 6·988 centimètres, with 250·317 grammes of sugar. The patient herself attributed to the rennet the power of allaying in some measure the burning thirst which she experienced.

XI. *On the Use of Sulphate of Atropia in Diseases of the Eye.* By Dr. FRIEDRICH MOSLER. (Archiv des Vereins für Gemeinschaftliche Arbeiten, 1856.)

As the result of practical investigations upon the use of sulphate of atropia in ophthalmic medicine, Dr. Mosler arrives at the following conclusions:—1. That the sulphate of atropia is preferable to the pure alkaloid for therapeutic purposes. In a state of purity the sulphate, employed with the necessary precautions, even in large doses (such as five grammes to an ounce of distilled water), produced no unfavourable effects upon the eye. In using it, care must be taken of the absorption of the tears running from the eye and mixing with the solution, and the absorption of the solution itself is to be guarded against. 2. In ophthalmoscopic investigations, atropia has rendered especial services in many cases; in order to diminish as much as possible the inconvenience felt by the patient in its use, attention must be paid to the investigations of Donders, upon the more or less enduring operation of the different

strong solutions. The employment of atropia is not *à priori* to be recommended in every ophthalmoscopic investigation. 3. In inflammatory states of the eye, especially those characterized by violent pain, intolerance of light, and abundant lachrymation, as particularly in injuries of the eye, with or without affection of the iris, we have been acquainted with atropia as an essentially soothing agent, as by its operation on the sensitive nerves of the eye it possesses the power of removing rapidly the state of excessive irritation. As a decided remedial agent, it appears moreover to act by its operation upon the motor nerves in the eye, inasmuch as, according to the explanations of Dr. Von Gräfe, it paralyses the muscles which are found in and about the eye, and which in such cases exercise an excessive pressure upon the internal structures of the eye, and in consequence of the return of the blood being impeded, give rise to accumulation of blood in those structures. It is thus explained why abscesses of the cornea under its use are less perforating and more easily healed, and why hypopyon is more rapidly absorbed. 4. Astringent eye waters, especially the stronger cauterizing fluids, are better borne, and are attended with more rapid success, when the excessively heightened sensibility of the eye, which exists in the cases where this remedy is applicable, has been previously deadened by atropia. 5. Cauterization of the eye, employed only once daily with all necessary precautions, is better borne in many cases than the more frequent instillation of eye-waters, which every time appear to induce a new and well-marked irritation.

XII. *On the Employment of Iodide of Calomel (Chlorure Mercureux) as a Local Application in Uterine Engorgement.* By Dr. F. Rochard. (L'Union Médicale, January 6th, 1857.)

Dr. Rochard having applied the iodide of calomel in certain hypertrophic and sub-inflammatory affections of the neck of the uterus, has arrived at the following conclusions in favour of this kind of medication.

When a pledget of charpie, covered with a pommade of iodide of calomel, is applied to the neck of the engorged uterus, ulceration being absent, the women in general experience no particular sensation, but sometimes they feel towards the conclusion of the application a slight sensation of heat in the hyypogastric region; when ulceration exists the sensation of heat is manifested very early, and is habitually followed by pains which may be rather severe. As soon as the dressing is removed, the sensation or even the pains are immediately relieved, and the neck of the uterus when examined appears more voluminous than before. If it is not ulcerated, there is formed upon all the surface of the mucous membrane touched by the pommade a thin exudation of a greyish-white colour, and of a consistence rather less than that of boiled albumen, which, when examined by the microscope, exhibits neither pus, nor epithelium, nor fibres, but only a granular, transparent, and apparently amorphous mass. When the neck is ulcerated, the same exudation is formed, but it does not remain adherent to the mucous membrane, and is removed with the dressing; in this case it contains some remnants of deformed epithelium. Besides this exudation, the charpie which has served for the dressing is always moistened with a serous liquid, sometimes sufficiently abundant to flow outwards and to form greyish spots upon the patient's linen. In the days succeeding the dressing, the exuded coagulum is detached by degrees, the volume of the os uteri diminishes, and becomes less than it was before the topical application; if there was any induration, which is generally the case, this induration is much less from the day succeeding the dressing. At the end of eight, ten, or twelve days, if the amelioration has made no progress, the dressing is renewed, and gives rise to the same phenomena, although in a less marked degree; and

after two, three, four, or five applications made at the same intervals, the os is usually restored to its normal volume, and the ulcerations are cicatrized. The patients, who feel themselves *less heavy* on the first application, are relieved from all painful sensation, particularly those who had no ulceration. The latter recover only after a longer period; the others can generally walk with ease after the second application, even when walking was previously impossible. The mode of applying the pommade is by preparing a pledget of charpie of suitable thickness, and of rather larger dimensions than the volume of the os uteri. The centre alone is covered with a light layer of the pommade, so that the edges which remain dry defend the vaginal mucous membrane from the contact of the application, which might cause inflammation.

XIII. *On the Treatment of Scrofulous Affections by the Iodide of Potassium.* (L'Union Médicale, February 17th, 1857.)

Dr. Vincent Duval adopts the following plan in the administration of iodide of potassium in infantile scrofula. In children from one to three years of age, he prescribes the iodide of potassium in solution in distilled water, in the dose of ten to fifteen centigrammes a-day during the first week, and of twenty to thirty in the three succeeding weeks. At the end of this time he discontinues the use of the drug for a week, and during this interval he purges the patients with castor oil, or preferably with calomel. Then he recommences the use of the iodide as before. At the end of two months, if the digestive passages are in an unfavourable condition, he orders one or two grammes a-day of bicarbonate of soda, dissolved in sugared water or the infusion of hop. After a fortnight or a month of the use of the bicarbonate, he returns, if necessary, to the employment of iodide or bromide of potassium for one or two months. In children of more advanced years, the dose must be augmented in proportion; but even in adults, Dr. Duval seldom gives more than one gramme in a day. He often adds to the iodide of potassium the sulphate or the citrate of iron, more frequently the latter. When the patients are thin and weak, cod-liver oil agrees very well, not only as an iodized medicine, but also as a fatty body; it renders the blood more plastic and more fibrinous, the respiration more active, and the absorption of oxygen more abundant. Given at the same time with the iodide of potassium, this latter medicine does not cause emaciation in the patients. If citrate of iron is added, independently of the iodide of potassium, its action is still further augmented. [Combinations, ready prepared, of cod-liver oil with iodine, iron, and other alteratives and tonics, have been long employed in British practice.—Reporter.]

XIV. *On a New Principle of the Colchicum autumnale.* (L'Union Médicale, January, 10th 1857.)

M. Oberlin has just communicated to the Académie des Sciences at Paris some observations on the Colchicum autumnale, from which he has extracted a neutral crystalline principle which he calls *colchicéine*, and which differs from *colchicine*, a complex and uncrystallizable product. The properties of colchicéine are to crystallize very easily in pearly laminæ, and to be almost completely insoluble in water, but to communicate to this fluid a slight bitterness, which increases sensibly when it is boiled. At this temperature a notable part of the product is dissolved, but is deposited immediately after cooling. The solvents of colchicéine are alcohol, ether, methylated spirit, and chloroform, which contract, when mixed with it, a very intense and persistent bitterness. The alcoholic solution of colchicéine is coloured by the addition of bichloride of

platinum, but no precipitate is formed. Pure concentrated nitric acid dissolves colchicéine, and becomes coloured of a very intense yellow tint, passing into a violet colour, then to a deep red and a clear red, and finally returning to its primitive yellow colour. Concentrated sulphuric acid forms with it a solution of a very intense yellow colour, which is preserved even when it is diluted with water, and brownish flocculi are formed in it. Hydrochloric acid dissolves it with a clear yellow colour. The acetic acid also dissolves it, but without change of colour. Colchicéine is soluble in ammonia, and crystallizes by evaporation in the air; and it dissolves in caustic potash. It is unalterable in the air; it has no effect upon turmeric paper or litmus paper; exposed to heat, it first softens and afterwards fuses at 155° (Cent.?). The elementary composition of colchicéine is C 62, 83+H 6, 60+N 4, 19+O 26, 38=100, 00.

XV. *On the Treatment of Strangulated Hernia by the Internal Use of Belladonna.* (L'Union Médicale, January 27th, 1857.)

Dr. de Larne, of Bergerac, relates the following case, in which the employment of belladonna combined with the taxis succeeded in effecting the reduction of a strangulated hernia. An old woman, aged seventy, had suffered for about seven years from a crural hernia of the right side, which however did not generally give rise to inconvenience or pain. On rising from bed on the 17th of September, 1856, she experienced the symptoms of strangulation of the hernia; the belly was stretched, tympanitic, and painful to the touch; there was repeated vomiting, most frequently stercoraceous; total absence of evacuation by the anus; small, weak pulse, without marked frequency; skin dry, moderately hot; respiration anxious; slight thirst; dislike of food: the tumour was resistent, of a violet hue, as large as a turkey's egg. All attempts at manual reduction having failed, the patient was ordered rest, low diet, a suitable position, cold water for drink, and a belladonna mixture. The latter preparation was composed of the watery extract of belladonna, 20 centigrammes; of syrup of orange flowers, 30 grammes; and of distilled water, 60 grammes. It was given in the dose of a teaspoonful every quarter of an hour, and was continued for nearly four days, when the obstacle having been sufficiently removed by the use of the belladonna, the hernia yielded readily to the taxis. The author of the communication observes, that during the administration of this drug a notable and real amelioration of the tumour was observed, although the strangulation continued; and that, notwithstanding the dose (which amounted altogether to one gramme and a half of the extract of belladonna), only a few alternations of delirium or sleep were induced, without any other toxical symptoms of importance.

XVI. *On the Therapeutical Applications of Glycerine. Supplemental Notes.* By Dr. W. Lauder Lindsay. (Edinburgh Medical Journal, April, 1857.)

In continuation of the remarks previously made by Dr. Lindsay on the therapeutical applications of glycerine, he has collected together a large amount of evidence in favour of this substance as a remedial agent in various affections, employed both internally and externally. As an internal medicine, it would appear to possess properties very similar to those of cod-liver oil, but it has the recommendation of being more pleasant to take; and in certain cases where the cod-liver oil was not tolerated, glycerine has been used as a substitute with the best results. It should be mentioned that the effects of glycerine vary considerably in proportion to the kind of article supplied, and that the specimens obtained from various sources are by no means of equal purity and value. As an external application, glycerine may be considered as

a palliative, if not a specific, in a variety of skin diseases. The evidence adduced from the practice of several surgeons proves that it is a very valuable application in scalled head, in combination with hyposulphite of soda; in itch, combined with sulphur; in inveterate psoriasis; in pityriasis, lepra, lichen, eczema, impetigo, prurigo; in certain forms of lupus, and of strumous and syphilitic eruptions. As a solvent or excipient, or vehicle for pharmaceutical preparations, glycerine is now much employed; and Messrs. Price and Co., of London, have prepared a series of medicinal compounds, in which glycerine is the solvent basis. It is much to be regretted that the price of glycerine is still so high as to preclude its general use among the lower classes.

HALF-YEARLY REPORT ON PHYSIOLOGY.

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I. On Food and Digestion.

1. Vernois and Becquerel: *Analysis of the Milk of the principal types of the Cow, the Goat, the Sheep, and the Buffalo.* (L'Union Médicale, t. xi., No. 26, 1857.)
2. Berthé: *On the Assimilation of different Oleaginous Substances.* (L'Union Médicale, t. x. No. 62, 1856.)
3. Corvisart: *On a Function of the Pancreas which is little known: Digestion of Azotized Substances.* (L'Union Médicale, t. xi. No. 50, 1857.)
4. Colin: *On the Digestion and Absorption of Fats without the Influence of the Pancreatic Juice.* (L'Union Médicale, t. xi. No. 50, 1857.)
5. Donders: *On the Absorption of Fat in the Intestinal Canal.* (Moleschott's Untersuchungen zur Naturlehre, vol. ii. p. 102, 1857.)
6. Kölliker: *Remarks on the Absorption of Fat in the Intestinal Canal; on the Existence of a Physiological Fat-Liver in Young Animals; and on the Functions of the Spleen.* (Verhandl. der Würzburg. Gesellschaft, vol. vii. p. 174, 1856; and Schmidt's Jahrb., vol. xciii. p. 20, 1857.)
7. Von Wittich: *Contribution to the Doctrine of the Absorption of Fat.* (Virchow's Archiv, vol. xi. p. 37, 1857.)
8. Moleschott: *New Proof of the Entrance of Solid Particles into the Conical Cells of the Intestinal Mucous Membrane.* (Moleschott's Untersuchungen zur Naturlehre, vol. ii. p. 119, 1857.)
9. Hollander: *Contribution to the Researches regarding the Entrance of Small Solid Bodies from the Intestinal Canal into the Blood.* (Virchow's Archiv, vol. xi. p. 100, 1857. Extract from an Inaugural Dissertation.)

Vernois and Becquerel offer the results of the analysis of the milk of sixteen different breeds of cows, five of goats, one sheep, and one female buffalo. They infer from their observations, that the composition of the milk varies considerably with the country in which it is examined; the country where an analysis has been made ought therefore always to be stated. 1. While the cows of Paris and its neighbourhood give 36 to 37 parts of butter to 1000, those of the Tyrol, Switzerland, Holland, and those of the Angus-race yield 70 to 98 parts. 2. There exists an antagonism between the richness of the milk in butter and albumen, and the richness in casein and sugar; a difference which is so marked, that it allows a division into butter-cows and cheese-cows (*vaches à beurre et vaches à fromage*). 3. An analogous difference the authors found in the milk of women and of sheep. Here, too, the greatest degree of variation is found with regard to the per-centage of butter. 4. One cannot, in an absolute manner, declare one kind of milk superior to another;

but that of one breed may be preferable in a certain case on account of the larger quantity of butter, that of another in a second case on account of the greater richness in casein, that of a third may be chosen for its proportion of sugar, &c. Thus, the Angus-breed yields most butter, the Norman race most casein. 5. The quantity of food appears to be of considerable influence on the proportion of the different constituents; a large quantity seems to cause an increase of sugar and casein, a moderate quantity to induce an increase of butter and albumen. 6. The authors draw especial attention to the large per-centage of albumen (13 to 1000) in the milk of goats, as also to the richness of the female buffalo, in solid substances in general, and in albumen (13) and butter (80) in particular. Finally, Vernois and Becquerel express the opinion, that the milk of nurses of different climates may offer similar differences as that of different races of cows, according to the differences in soil, in food, &c., corresponding probably to the varieties in character and customs of different nations.

The fact that some fatty substances, when eaten, are almost entirely excreted by the alvine dejections, while the amount of fat in the fæces does not become increased by the moderate consumption of other fats, led Berthé to the examination of the quantity of fat excreted with the fæces under the influence of various oleaginous matters administered to the same healthy subject in doses of from thirty to sixty grammes per diem. These experiments led the author to the inference, that there is a point of saturation of the body for most of the fatty matters, from whence almost the whole amount of fat ingested passes unassimilated through the intestinal canal. This point is arrived at after about twelve days with olive and almond oil, and almost all vegetable oils; after about a month with butter, whale oil, and English purified cod-liver oil (*huiles de baleine et de foie de morue Anglaise, décolorées ou lavées*); while the use of the pure brown cod-liver oil (*huile de foie de morue brune et pure*) did not lead to an increase of fat in the fæces, even when its use had been continued for more than a month. Berthé therefore proposes a division of the fatty substances into three groups:—1. Substances of difficult assimilation (olive, almond oil, &c.); 2. Assimilable substances (butter, whale oil, English cod-liver oil, and probably all animal fats); 3. Very assimilable substances (brown and pure cod-liver oil).

Corvisart confirms the observation of Purkinje and Pappenheim regarding the existence of a substance in the pancreas (pancreatine) endowed with the virtue of dissolving azotized constituents of food. The author contends that the pancreatic juice exercises its influence only on that part of the nitrogenous substances which has escaped the action of the gastric juice, producing a kind of albuminose similar to that resulting from the influence of the gastric juice. The reaction of the surrounding fluid, whether alkaline, neutral, or acid, is of no importance regarding the performance of this function of the pancreatic juice. Corvisart further states that the active principles of the gastric and pancreatic juice (pepsine and pancreatine) counteract each other when mixed together; that in the normal condition this is prevented, *a*, by the pylorus; *b*, by the gastric digestion itself, through which the pepsin is consumed; *c*, by the admixture of the bile, which destroys the power of the pepsin.

Colin's experiments regarding the absorption of fats are made on cows, in which he considers the formation of pancreatic fistula, and the opening of the pancreatic duct, as easy operations. Comparing the contents of the thoracic duct obtained from cows in which a pancreatic fistula had been established, with that of others where the pancreatic juice was not removed, the author arrived at the inference, that after the elimination of the pancreatic juice, the fat is digested and absorbed in the same manner as in the normal condition. It will be remembered that the experiments of Lenz, Herbst, and others led to the same result.

Donders, too, found that absorption of fat takes place without the influence of the pancreatic juice; that, however, this process is assisted by the emulsifying power of the pancreatic fluid. Donders further refers, respecting the absorption of fat, to the results of Von Wistinghausen's experiments, that the passage of fat through animal membranes is much facilitated by their previous impregnation with bile. Microscopic observation leads the same author to consider the presence of canaliculi in the thickened walls of the epithelial cells of the intestines, as described by Funke and Kölliker, as highly probable.

Kölliker proved, by injection of oil into the rectum of a young cat, the possibility of the absorption of fat through the epithelial cells of the colon. He further constantly found fat in the epithelial cells of the stomach of sucking animals, but no white chyliferous vessels. He corroborates Brücke's observation, that fat is absorbed by the follicles of Peyer's glands, but does not offer decided proof in favour of the absorption of fat by bloodvessels.

Hollander repeated at Dorpat, under the superintendence of Bidder, some of the experiments of Marfels and Moleschott. The authors injected in many instances the defibrinated blood of oxen, calves, and sheep, through an elastic tube, into the stomach of frogs; they continued doing this in the same animals for several days running, once or twice daily, but they never succeeded in finding any of the injected globules in the blood of the frogs. The essay shows that the experiments were performed with much care, but the negative result does not offer a valid objection to the permeability of the epithelial cells of the small intestines, as it appears more than probable that the blood-globules had undergone a considerable alteration under the influence of the gastric juice, before they reached the cavity of the jejunum and ilium.

Donders, likewise, in a great number of experiments, never succeeded in obtaining a proof for the passage of solid molecules through the epithelial cells of the intestinal tube.

Moleschott, on the other side, has repeated many of his former experiments, in order to find under which circumstances the entrance of solid particles into the cells takes place. Although he again obtained many positive results, principally when he had employed recently-precipitated particles of Berlin blue, yet he has hitherto not been able to ascertain which are the most favourable circumstances, or why the absorption takes place in one case, and not in several others.

Von Wittich contributes an observation of great importance regarding the question at issue. A rabbit killed (by bleeding) six hours after it had been bitten in the back by a dog, and thus deprived of the use of its posterior limbs, exhibited the chyliferous vessels, originating from the lower half of the ilium, filled with an entirely red fluid. This redness was shown to be caused merely by the admixture of the red blood-globules in a large proportion, not by that of colouring matter. The corresponding part of the intestinal tube contained mucus mixed with blood, after the removal of which the mucous membrane manifested the appearance of fine red dots, which, by means of a lens, were recognised as villi filled with blood. Von Wittich does not hesitate to explain this state of things by adopting the view, that the blood-globules pass as such through the epithelial cells and the parenchyma of the villi into the chyliferous vessels; he is of a similar opinion regarding the entrance of fat and other minutely-divided solid substances into the absorbent vessels. After various unsuccessful attempts, the author succeeded also, by means of the experiment, in proving the entrance of blood-globules into the chyliferous vessels of the cæcum, five hours after he had injected blood into that portion of the intestinal canal. Von Wittich agrees with Brücke and Moleschott, in opposition to Hyrtl and others, in attributing to the contraction of the muscular coats of the intestinal tubes much influence on the absorption of substances contained within its cavity.

II. Blood; Respiration; Circulation.

1. Zimmermann: *On Fibrin, and the Cause of its Coagulation.* (Moleschott's Untersuchungen zur Naturlehre, vol. i. p. 133, 1856.)
2. Harley: *On the Chemical Changes of the Blood during Respiration.* (Virchow's Archiv, Band xi. p. 107, 1857.)
3. Bernard: *On the Elimination of Sulphuretted Hydrogen through the Surface of the Lungs.* (Archiv. Génér. de Méd., Fevr. 1857.)
4. Hoppe: *On the Influence of Carbonic Oxide on Hæmato-globulin.* Preliminary communication. (Virchow's Archiv, Band xi. p. 288, 1857.)
5. Hoppe: *On the Influence exercised by Change of the Pressure of the Air on the Blood.* (Müller's Archiv, p. 63, 1857.)
6. Valentin: *Contribution to the Knowledge of the Hybernation of Marmots.* (Moleschott's Untersuchungen zur Naturlehre, Band i. p. 206, 1856.)
7. Aberle: *On the Measurement of the Diameter of Arteries in Living Man.* (Dissert. Inaugur., Tübingen, 1856.)
8. Wagner, R.: *On the Observation of the Circulation of the Blood, and the Locomotion of the Chyle in Warm-blooded Animals.* (Göttinger Gesels. der Wissenschaft., No. 13, 1856; and Schmidt's Jahrb., Band xciii. p. 18, 1857.)
9. Kunde: *Physiological Experiments on Apparent Death.* (Müller's Archiv, Jahrgang, 1857, p. 280.)

Regarding the nature and origin of fibrin, Zimmermann repeats that he considers it as an excrementitious substance, exhibiting a certain stage in the metamorphosis of proteinaceous bodies, not any longer fit to serve in the nutrition of the organism. A small quantity of fibrin is regarded as a necessary constituent of the blood, but "the healthier the subject, the smaller the quantity of fibrin." By further oxidation, fibrin is, in the normal state, transformed into other excrementitious circumstances. "Sometimes, however," the author says, "the formation of fibrin takes place in so tumultuous and rapid a manner, that the transformation into excrementitious substances cannot take place; whence arises exudation of the accumulated fibrin, a process through which the blood is, for the time, purified of this substance. Later, when the cause for this abnormal crisis has ceased, the fibrin may again be absorbed and otherwise excreted. Such is the case in pleuritis, pneumonia, &c." (p. 181.)

The coagulation is caused, according to Zimmermann, by the commencement of decomposition or putrescence; it is accelerated by the addition of substances in the state of transposition of elements, as pus or ichorous fluid from gangrenous wounds (Nasse), in the whole by all influences favouring putrescence; it is retarded, on the contrary, by such influences as retard or prevent decomposition. The putrescence causing the coagulation of fibrin does not take place in the fibrin itself, but in other constituents of the blood, and principally in the red blood-globules. The chemical constitution of the fibrin passing into the solid state is regarded as remaining unchanged, with the exception of transposition of its atoms, effected by the contact with a substance in the state of decomposition, analogous to the transformation of casein by the action of rennet.

Harley describes some valuable experiments which he performed at Heidelberg in the laboratory of Professor Bunsen, and with the assistance of that distinguished chemist. After having repeatedly shaken a certain quantity of blood with renewed portions of atmospheric air, until it was saturated with oxygen, and had given off as much carbonic acid as possible, he placed the blood thus treated with an equal volume of atmospheric air, in an hermetically-closed vessel, shook it frequently, and examined the air after it had been for a varying space of time in contact with the blood. In this manner the author found the air, after twenty-four hours' contact with fresh blood of oxen, to have lost

10·54 per cent. oxygen, and gained 5·05 per cent. carbonic acid. In another experiment with fresh arterial calves' blood, the minus of oxygen in the air employed was 9·63 per cent., the surplus of carbonic acid, 5·96 per cent. In both experiments, we meet with a greater loss of oxygen than is accounted for by the surplus of carbonic acid: the author inclines to the view that this remnant of oxygen is spent in the formation of water. Amongst Harley's experiments respecting the share which the various constituents of the blood exercise on the atmospheric air, we observe that those performed with *fibrin* lead to a result similar to that described by Scherer,* i.e., that fibrin has the power of absorbing a considerable quantity of oxygen, and of giving off carbon or carbonic acid. *Albumen,* too, was found to be possessed of the same property; but the quantity of oxygen absorbed, and that of carbonic acid excreted, are not so great as is the case in the experiment with fibrin. The comparative experiments with the *coagulum* and the *serum* of blood, manifest that the absorption of oxygen and the excretion of carbonic acid are larger in the former than in the latter case. *Hæmatin* was observed to exercise on the surrounding air the same influence as that ascribed by Scherer to the urohæmatin—namely, to deprive the air of a large amount of oxygen, and to enrich it with carbonic acid—a virtue which Harley attributes to the colouring substances in general, as well in the vegetable as in the animal economy.

Although the author's researches on the subject are not yet brought to an end, yet the experiments before us make it probable (in opposition to the view formerly maintained by Magnus) that a part of the oxygen admitted during respiration enters at once into a chemical combination with the various constituents of the blood.

The circumstance that *sulphuretted hydrogen* can be ingested in considerable quantity into the digestive canal without producing symptoms of poisoning, while the admixture even of so small a proportion as one part to 800 parts of air is sufficient, when inhaled, to kill a middle-sized dog, led Bernard to search, by means of experiments, for the cause of this remarkable difference. The injection of sulphuretted hydrogen gas into the jugular vein was rapidly followed by several deep inspirations and expirations, through which a large quantity of sulphuretted hydrogen was eliminated (proved by testing with acetate of lead); this process of elimination being completed within a few seconds. Similar was the effect when a concentrated solution of the gas was injected into the jugular vein. The ingestion of such a solution into the stomach was likewise followed by exhalation of the gas; but the interval between the ingestion and the exhalation was considerably greater, and the process of elimination lasted longer. Injection of the solution into the rectum led to an analogous result, sixty-five seconds having elapsed before the first traces of the sulphuretted hydrogen were discovered in the expired air.

The author alludes to the value of such experiments for the determination of the celerity of absorption, circulation, &c. Thus the injection of the solution into the jugular vein led to dark spots on the test paper after three seconds; that into the crural vein only at the end of six or seven seconds; showing the greater space of time required for the transmission of the blood through a greater distance. The question, whether the whole amount of the sulphuretted hydrogen injected is exhaled through the lungs, Bernard is inclined to deny, as the injection of a small quantity into the arterial system of a dog did not cause the appearance of any gas in the expired air. This, however, took place when another injection was made soon after the first.

The observation made by Dr. Wolff, of Waldenburg, in Silesia, that the blood of labourers who had perished in coal-mines, and that of rabbits killed by means of carbonic oxide, are bright red, induced Hoppe to examine the change

* Scherer, in Liebig's Annalen, vol. xl.

caused in the defibrinated blood of oxen by the admixture of carbonic oxide. As well the arterial as also the venous blood of oxen, when shaken with this gas, becomes bright red—the redness differing, however, from that of the normal arterial blood by being possessed of a violet hue. Neither the action of carbonic acid, nor that of atmospheric air, nor that of commencing decomposition, effect a change in the colour produced by the carbonic oxide. From these facts the author infers that the gas is not only absorbed by the blood, but enters into a chemical combination with the hæmato-globulin, by which circumstance the blood-globules lose their virtue of being the bearers of oxygen.

Hoppe exposed various animals to a considerably *diminished atmospheric pressure*, by means of the air-pump. The symptoms exhibited by different classes of animals were very different. Frogs and a blind-worm bore the reduction of pressure to 30 millimetres mercury, and below this, without dying: swelling up of the whole body, expulsion of gas through mouth and anus, and syncope, were the principal symptoms. Rats and young cats became suddenly convulsed at a pressure of 50 millimetres; the convulsions were soon followed by syncope. Admission of air in this state restored them to apparent health, but these animals died at the reduction of the pressure to 40 millimetres. In guinea-pigs, sudden diminution of pressure to 80 millimetres caused convulsions and syncope. Two swallows became convulsed when the pressure was not lower than 130 millimetres, and died at the reduction to 125 millimetres. All the animals killed by low pressure exhibited small bubbles of air in the large vessels and in the right ventricle, while no air was found in the blood-vessels of frogs examined in the state of syncope. The author directs attention to the facts, that birds die before the pressure is reduced to the boiling point of the blood, that mammalia die at a pressure slightly exceeding the boiling point, while amphibia survive the reduction to the boiling point. Hoppe ascribes the symptoms caused by low pressure, not to the want of oxygen in the blood, but to the development of gas within the vessels: the sudden death is considered as the effect of the blocking-up of the pulmonary capillaries by this gas. The point at which the development of gas takes place, appears to depend on the preceding degree of pressure on the temperature of the animal, and the greater or smaller power possessed by the blood of absorbing gases—which power is probably dependent on the proportion of blood-globules.

Regarding the influence of *increased pressure*, the author offers only a few experiments. An increase of 150 millimetres (i.e., to about 908 millimetres) was borne by a pregnant rat without any symptoms of uneasiness. *A priori*, it is to be supposed that the blood must show an increased power of absorbing gases, augmented heat, &c. Sudden diminution of the previously-increased pressure of air probably leads to development of gas within the vessels, and the pathological phenomena just mentioned. Hoppe is inclined to attribute cases of sudden death without anatomical lesion, observed in coal-mines, to this cause.

If we compare with these results Valentin's observations on marmots during the state of hybernation, we find that this author, too, witnessed symptoms of great uneasiness when the *reduction of the pressure* was carried to below 10 millimetres, which was equal to about $\frac{1}{71}$ of the pressure of the surrounding air; but, after some time, the animals became again quiet, and continued to sleep. On further reduction to $\frac{1}{81}$ of the external pressure, the symptoms exhibited by the animal, after having been for more than two hours under this influence, were such, that though the sleep was not interrupted, yet Valentin considered it necessary to admit air in order to save the animal. In another experiment, when the air was extenuated to 4·1 millimetre—i.e, to $\frac{1}{175}$ of the external pressure—a stream of blood rushed from the animal's nostrils, but by the admission of air of the usual density the animal recovered quickly. The

appearance of a greater quantity of moisture at the nostrils was a regular phenomenon produced by the more rapid extenuation of the surrounding air. Valentin particularly points out the difference in the effect of a rapid and gradual diminution of pressure, the latter being borne much better than the former. The same author has also frequently subjected sleeping marmots to *increased pressure*. When the air is pumped in slowly, the pressure could be increased to that of three atmospheres (2160 millimetres) without awaking the animals, or producing any striking symptoms; rapid pumping in of air caused the animals to awake for a short time; sudden emission of the condensed air had the same effect, and effected in all animals a profuse discharge of mucous fluid from the nostrils, and in one case hæmorrhage from the same parts. The record of the other contents of Valentin's valuable paper on the hybernation of marmots we must defer to the next Report.

Aberle measured with Vierordt's instrument, and under the superintendence of that physiologist, the diameter of the radial artery, on several persons, and at different periods of the day. He found that the diameter of the artery is larger in the afternoon (after dinner) than in the forenoon. The average diameter, in different persons, varied between 2·09 millimetres (short stature) and 3·18 millimetres (tall people); in the forenoon we find the figures, 1·74—2.92 millimetres; in the afternoon, 2·45—3·44 millimetres.

Wagner recommended, as the best object for the observation of phenomena connected with the circulation, the mesenteric vessels of young cats or rabbits under the influence of ether, as offering a much more distinct view of the capillary circulation than other objects generally used. The author constantly saw in his examinations the following three different formative elements: *a*, red globules, principally in the more rapid central part of the stream; *b*, colourless granular globules, of much slower movement, in the peripheric part of the stream, where they sometimes considerably accumulate, through the diminished power of the heart; *c*, small, sometimes aggregated, strongly refractive globules, much like fat-granules. The observation relating to the colourless globules shows, that the estimation of their proportion in a drop of blood, abstracted from a certain part, may lead to erroneous conclusions, as their quantity may vary, in the same vessel at different times, with the variation of pressure, &c. The turgid chyliferous vessels of the mesentery exhibit only very small molecules, here and there larger fat-globules, and always a few red blood-discs, the progressive movement of which could be distinctly traced. This movement was not continuous, but periodic. The contraction of the villi and of the intestinal canal, and other movements of the animal, appeared to exercise influence on this motion; the acts of respiration did not seem to promote it. Sometimes, in the course of the observation, the chyliferous vessels became almost filled with blood-globules, which the author is inclined to explain by the supposition of the rupture of small bloodvessels within the villi.

Kunde adopts Bichat's view regarding the three principal organs from which death may originate, substituting, however, the medulla oblongata for the brain. Apparent death may be artificially produced from every one of these organs. The author's experiments relate, however, principally to apparent death from the heart. The method adopted by him consists simply in compression of the atria of the heart between the fingers, which can easily be effected in young cats, dogs, rabbits, and in frogs, without any lesion of the thorax. If the heart of a young cat is compressed, the respiratory movements continue for a time, the diaphragm contracts, and the animal cries; soon the mucous membrane of the mouth and nose becomes blue, and then completely pale; after this, the respiratory movements cease, the pupils become dilated, the voluntary and reflex movements cease. If the compression is at this period discontinued no sounds of the heart are perceived; but soon the first sound reappears, and then the second, and the heart resumes its functions as usual.

After this, a respiratory movement is observed preceding all the other motions of the muscles of the trunk or limbs; later, the mucous membranes regain their colour; finally, the animal rises, moves first in an unsteady manner, but by degrees recovers completely. In the frog, the author witnessed the cessation of the reflex movements at first in the posterior extremities; the lymph-hearts cease last; the animal appears without life; the capillaries contain only a small quantity of blood; the veins are gorged. Further experiments, performed on frogs under the influence of strychnia, show that the tetanic convulsions become suspended as soon as the heart is compressed, and reappear after the discontinuance of the compression. The author concludes from this fact, that paralysis of the nerves may be produced by a mere change in the tension of the vessels. He is further inclined to confirm Bichat's proposition, that an important influence is exercised on the brain by the motion incessantly imparted to it through the contractions of the heart. In favour of the latter inference, Kunde adduces Heidenhain's* discovery, that a tetanic state of a nerve may be caused by a continuous repetition of mechanical concussion; and points to the constantly-repeated shocks applied to the nervous centres by the passage of the blood-globules through the capillaries.

In the course of these experiments, Kunde was enabled to confirm in many points Kussmaul's observation regarding the influence of compression of the bloodvessels and the heart on the state of the iris. Contraction of the pupil was the first phenomenon, which was soon followed by rotatory movements of the bulb, anæmic state of the vessels of the iris, dilatation of the pupil, slight convulsions, and exophthalmus, with complete dilatation of the pupil. Suspension of the compression is followed only after fifteen to twenty seconds by gradual contraction of the pupil. Dilatation, however, was the only constant phenomenon, and this is the regular consequence of diminished pressure from the heart, whatever may be the cause of the latter.

III. Ductless Glands.

1. Kölliker: *On the Function of the Spleen.* (Loc. cit., sub. i.)
2. Iaschkowitz: *Contribution to the Experimental Pathology of the Spleen.* (Virchow's Archiv, Band xi. p. 235, 1857.)

Kölliker's researches confirm the view, which is being more and more generally adopted, that the colourless blood-globules are formed in the spleen; and partly in that organ itself, partly in the liver, partly in the blood, are transformed into red globules.

Iaschkowitz studied the effect produced by section of the plexus lienalis on the structure of the spleen. Nine experiments performed on dogs, by section either of the whole plexus lienalis, or only of the superior or inferior half of it, show that this section causes in the corresponding part of the splenic tissue an altered state—viz, congestion of blood, softening, tension of the capsule, effusion of coagulating blood in large quantity through incisions into the capsule. We see, therefore, that the result of these experiments is analogous to that of section of the sympathetic nerve of the neck; and the author draws the inference, that mere nervous disturbance, without pathological change in the composition of the blood, may cause an alteration of the tissue of the spleen. Further experiments must elucidate the influence exercised by such alterations of the spleen on the mixture of the blood.

The same author observed, during these experiments, contraction of the spleen in the direction of the longitudinal axis, as well under the influence of galvanic irritation as under that of the atmospheric air.

* Heidenhain: Physiologische Studien. Berlin, 1856.

IV. SECRETION; EXCRETION; METAMORPHOSIS OF MATTER.

1. BERNARD: *On the Influence of Alcohol and Ether on the Secretion of the Intestinal Tract, the Pancreas, and Liver.* (Gaz. de Paris, No. 19, 1856; and Schmidt's Jahrb., vol. xciii. p. 24, 1857.)
2. DORNBLUTH: *Observations on the Mechanism of the Secretion of Urine.* (Zeitsch. für Rat. Med., vol. viii. p. 174, 1856; and Schmidt's Jahrb., vol. xciii. p. 275, 1857.)
3. BEIGEL: *Researches on the Quantity of Urine, Urea, &c.* (Wien, 1856; and Schmidt's Jahrb., vol. xcii. p. 5, 1856.)
4. V. FRANQUE: *Contribution to the Knowledge of the Excretion of Urine in Man.* (Dissert. Inaugur., Würzburg, 1855.)
5. NEUBAUER: *On the Decomposition of Uric Acid in the Animal Body.* (Annal. der Chem. und Pharm. vol. xcix. p. 206, 1856; and Schmidt's Jahrb., vol. xciv. p. 7, 1857.)
6. CLOETTA: *On the Presence of Inosit, Uric Acid, &c., in the Animal Organism.* (Annal. der Chem. et Pharm., vol. xcix. p. 289, 1856; and Schmidt's Jahrb., vol. xciv. p 9, 1857.)
7. DÉLORE: *On the Formation of Sugar in the Liver.* (Gaz. Méd. de Lyon, No. 2, 1856; and Canstatt's Jahrsber. der Physiologie, p. 160, 1857.)
8. CHAUVEAU: *New Researches on the Question regarding the Formation of Sugar.* (Compt. Rend., May, 1856; and Canstatt, l. c. p. 162.)
9. HENSEN: *On the Formation of Sugar in the Liver.* (Verhandl. der Würzburger Gesellsch., vol. vii. p. 219, 1856.)
10. HENSEN: *On the Formation of Sugar in the Liver.* (Virchow's Archiv, vol. xi. p. 395, 1857.)
11. BÉRARD: *On the Place of the Production of Sugar in the Organism.* L'Union Médicale, tome xi. No. 61, 1857.)

Bernard injected between five and six cubic centimetres (*i.e.*, rather more than $\frac{3}{10}$ths of a cubic inch) of alcohol, diluted with an equal quantity of water, into the stomach of a dog, and found a few minutes later, when the animal was killed, the stomach filled with fluid exhibiting the characters of gastric juice, and a considerable quantity of the secretions of the pancreas and the intestinal glands in the cavity of the digestive canal.

In order to learn the influence of alcohol on the glycogenic function of the liver, the author chose two dogs that were as much as possible in the same condition: after having deprived them of food for an equal space of time, he killed one of them immediately, the other after repeated injections of alcohol into the stomach. The liver of the former contained only a small, that of the latter a large, quantity of that insoluble substance which is afterwards transformed into sugar. The action of ether was found similar to that of alcohol; only more powerful.

The results of Valentin's experiments—that the quantity of albumen passing over from a solution of that substance, through a membrane into water, according to the laws of endosmosis and exosmosis, is increased or decreased by the greater or smaller degree of pressure acting on the solution—leads Dornblüth to the inference, that the absence of albumen in the urine indicates a low pressure acting on the secreting vessels of the kidneys. The circumstances leading to albuminuria are such as cause retardation in the return of the venous blood; and, through this, increased pressure on the secreting vessels—as contraction of the renal veins, tumours of the liver pressing on the vena cava, valvular diseases of the heart, &c. The pressure of the blood in the Malpighian bodies, the author argues, cannot be great, as the diameter of the vasa efferentia bears to that of the collected capillaries the proportion of 10 to 18, which must be connected with diminution in celerity and pressure. The impediment caused by the return of the blood from the capillaries into the

vasa efferentia is rendered smaller by the acuteness of the angles under which the transit takes place, by the communication of the vasa efferentia with wide meshes of capillaries, as also by the diminution of the quantity of blood, in consequence of the abundant secretion in the Malpighian bodies. This reasoning is borne out by the result of Ludwig's experiments, showing the pressure in the renal veins to be equal to that in the jugular veins. The prominent points in the mechanism of the secretion are, according to the author's view, that in the Malpighian bodies, under a low pressure, a diluted transudation takes place, carrying with itself the easily diffusible substances that are not retained by combination with proteinaceous constituents; the amount of solids in the transudation depends on the diffusive faculty and the relative quantity of the substances present in the serum of the blood. In the urinary tubuli an endosmotic interchange takes place between the transudation of the Malpighian bodies and the blood circulating in the capillaries round the tubuli; one of the principal results of this interchange being a transition of water from the fluid in the tubuli into the blood. The quantity of urine depends principally on the process in the Malpighian bodies; the larger the amount secreted by these, the more accelerated will be the stream in the tubuli, the less the time for absorption of water by the blood.

Beigel gives the result of his observations on ten healthy male and six healthy female individuals; the age of the former was between twenty and thirty years, height 169 to 176 centimetres, weight 74 to 79 kilogrammes; age of women, nineteen to thirty years, height 165 to 170 centimetres, weight 63 to 67 kilogrammes; diet of both sexes, mixed. Beigel adds remarks on the influence of very liberal and low diet, of exercise, and of several medicinal agents. Of similar nature are Von Franque's observations made on his own person, being in the twenty-second year, 173·8 centimetres high, weighing 62·64 kilogrammes. Both authors agree in corroborating the experience of other physiologists:—1st. That an increased ingestion of azotized food leads rapidly to increased egestion of urea through the urine. 2nd. That diminished ingestion of azotized food does not lead to a corresponding diminution in the excretion of urea; that continued abstinence from nitrogenous food is followed only after some time by a decrease of the normal quantity of the urea. 3rd. That the excretion of urea is much augmented by bodily exercise.

Beigel's examinations lead him, in addition, to the assertion, that Bischoff's inference regarding the coincidence of a high specific gravity of the urine and a large proportion of urea, is correct with reference to healthy male individuals, but not equally so to women, whose urine was found to contain in the average less urea than that of men, in spite of the high specific gravity. Another proposition arrived at by Beigel, as the result of his experiments, is, that increased metamorphosis of matter need not be connected with increased temperature, nor diminished metamorphosis, through insufficient ingestion of food, with decreased temperature, provided the abstinence be not continued too long.

Neubauer, after having ascertained the composition of the urine of rabbits living on their usual food, and especially the absence of uric acid, added between 2 and 3 grammes of uric acid to their daily allowance of victuals; the principal alteration thereby produced in the urine was an increase of urea from 1·3 grammes to 2, to 2·5, and even 4·2 grammes, which increase disappeared almost immediately when the uric acid was left off. Other experiments of a similar nature led to an analogous result. Neubauer infers from this, that uric acid is decomposed within the body into urea and carbonic acid. When a larger quantity of uric acid was given, a small portion of it was excreted as uric acid, and perhaps also in the shape of oxalic acid.

Cloëtta's memoir forms a contribution to our knowledge of the metamorphosis of matter, and particularly with respect to the questions, whether

certain products of decomposition are peculiar to certain organs and tissues, and which are the products met with in all, or almost all, the organs. Referring to the essay itself for the method of examination, we mention only—1. That the *lungs* of oxen yielded uric acid, inosite, taurin (which Cloëtta considers to be the substance mistaken by Verdeil for pulmonic acid), and leucin, but no glycin and tyrosin; 2. The *kidneys* of oxen contained, according to the first analysis, a large amount of inosite, cystin, and a small proportion of either xanthin or hypoxanthin, the quantity of the latter having been too minute to allow a distinction between these two bodies. A second analysis of the kidney of an ox manifested the same indefinite body, no cystin, but a large quantity of taurin; a circumstance which suggests the hypothesis, that these two bodies (viz., cystin and taurin) may sometimes take each other's place; 3. Neither in the *urine* of cows, nor in the normal urine of man, was inosite found; it was discovered, however, in that of a woman suffering from Bright's disease; 4. In the spleen the author proved the presence of inosite (in a similar quantity as in the lungs), of uric acid, hypoxanthin, leucin, and two other substances, the nature of which was not ascertained. Scherer's lienin is considered by Cloëtta as identical with inosite. 5. The *liver* of oxen contained as well uric acid as inosite. 6. Only a single examination of the blood of the jugular veins was performed, which did not show the presence of either of the two last-named substances.

Délore defends the correctness of Bernard's inferences regarding the formation of sugar in the liver, against the views propounded by Figuier.* He further corroborates the fact observed by Bernard,† that formation of sugar takes place in the liver, even after this organ has been most carefully washed out. He shows by experiment that the transformation of the glycogenic substance into sugar is not influenced either by electricity or by an atmosphere of pure oxygen, but that it is arrested by an atmosphere of hydrogen. In one of Délore's experiments, the formation of sugar lasted six days.

Chauveau communicated to the Académie des Sciences a series of experiments, performed as well on herbivorous animals provided with their usual food, as also on dogs fed exclusively on meat. He found sugar in the larger vessels even after several days' (one to six) abstinence from food; the arterial blood of the same animal contained the same proportion of sugar from whatever vessel it was taken; the veins of the various parts of the body, too, with the exception of the vena hepatica and the lower part of the vena cava, and of the vena portæ during the digestion of food, rich in sugar or starch, exhibited no remarkable difference regarding the per-centage of sugar in their blood. The following are the inferences arrived at by the author: 1. There does not exist any essential diversity between herbivorous and carnivorous animals regarding the sugar contained in their nutritive fluids, but the quantity of sugar is rather larger in the former than in the latter; 2. The sugar contained in the blood of the right heart is not destroyed in its passage through the lungs, but is transmitted unchanged into the left heart, and from thence into the aorta; 3. A certain amount of the sugar of the arterial blood disappears during the circulation through the capillaries, but part of this returns through the lymphatics to the right heart; 4. The large quantity of sugar in the blood of the hepatic vein, contrasted with its absence in that of the portal vein of animals deprived of food, or exclusively fed on meat, is a certain proof in favour of the formation of sugar within the liver.

Hensen's memoirs contain the results of his researches, made at Würzburg, in Scherer's laboratory. By the former of the two, the author does not only corroborate Bernard's discovery, already mentioned, regarding the presence of

* See British and Foreign Medico-Chirurgical Review, No. 33, p. 232. 1856.
† Ibid., No. 35, p. 282. 1856.

a glycogenic substance within the tissue of the liver, but he throws further light on the nature of this substance by the observation, that saliva and pancreatic extract materially accelerate the transformation into sugar. The experiments made, with the view to examine whether, perhaps, the ferment contained in the pancreatic juice is absorbed by the portal vein, and thus carried into the liver, do not allow of any decided conclusion.

In the second memoir, Hensen claims the merit of having isolated, independently of Bernard, the glycogenic substance of the liver. It appears certain that he has exhibited this substance before the Naturwissenschaftliche Gesellschaft, at Würzburg, in December, 1856, and again in Virchow's and Hoppe's Pathological Institution on the 1st of April, 1857; but the great French physiologist has the advantage in his favour of having first published an account of the nature of this substance, and of the manner in which it is to be obtained. As we have not yet received Bernard's publication, contained in the 'Gazette Médicale' of March 28th, we will defer our communication, as well on Bernard's as on Hensen's paper, to the next Report.

Bérard endeavours to disprove the correctness of Bernard's view, contained in the following words: "Le foie de l'homme, à l'exception de tous les autres tissus du corps, renferme de la matière sucrée." Bérard found sugar in the chyle of a bull fed exclusively on meat; he found this not only in the fluid of the thoracic duct, but also in the contents of a large chyliferous vessel situated on the mesenteric artery, thus showing that the sugar of the fluid examined was not derived by communication with the lymphatics of the liver. Bérard infers from this observation, that the sugar is not *exclusively* formed in the liver, and proposes, for further investigation, the questions,—whether not independently of the liver, sugar is constantly being formed in all parts of the body, and conveyed through the lymphatics to the centre of the circulation; and whether there does not exist, besides this constant production of sugar, another one of an intermittent, but much more active, nature under the influence of digestion.

V. Nervous System.

1. Chauveau: *New Experimental Investigations on the Properties of the Spinal Marrow.* (L'Union Méd., Nos. 61, 62, 66; 1857.)
2. Kölliker: *On the Vitality of the Nerve-Fibres of Frogs.* (Verhandl. d. Würzb. Gesellschaft., vol. vii. p. 145, 1856; and Schmidt's Jahrb., vol. xciii. p. 145, 1857.)
3. Flourens: *On the Sensibility of the Dura Mater, the Ligaments, and the Periosteum.* (L'Union Méd., tome xi. No. 53, 1857.)
4. Samuel: *On the Extirpation of the Plexus Cœliacus.* (Wien. Med. Wochenschrift, No. 30, 1856; and Schmidt, vol. xciii. p. 146, 1857.)

Chauveau, the distinguished professor at the Veterinary College at Lyons, whose observations on the movements and sounds of the heart we have related in the last Report on Physiology, has recently communicated to the Académie des Sciences the results of his experiments, performed on more than a hundred horses, asses, and mules, as also on many dogs and rabbits, regarding the nature of the spinal marrow. Although we have not yet before us the conclusion of the author's lectures, we will give the principal inferences as far as we are acquainted with them. 1. The *grey substance* of the spinal marrow is the conducting organ of the reflex phenomena. The posterior, as well as the antero-lateral white columns, may be dissected without the loss of the reflex function; but as soon as the grey substance of any part of the spinal marrow is thoroughly destroyed, no reflex action is observed to transgress that point, either from above downwards, or in the opposite direction. Thus, for instance, the grey substance having been destroyed in the middle of the dorsal

portion of the spinal marrow, pricking of the anterior limbs would cause reflex action in those limbs themselves, but none in the posterior limbs; and pricking of the posterior limbs would never cause any reflex motion in the front part of the body—i.e., in that part which is provided by the portion of the spinal marrow above the section of the grey substance. 2. The *grey substance* of the spinal marrow has nothing to do with the transmission of peripheric impressions to the encephalon. Thus this substance may be completely destroyed in the cervical portion, and yet the animal retain its sensibility undisturbed. 3. The *white columns* of the spinal marrow are the means of conveying the sensitive impressions to the brain. 4. The *posterior* of these columns do not form the principal organs for the transmission of sensitive impressions.

It will be seen from this preliminary report, that Chauveau is in opposition to Brown-Séquard in a most important point—namely, in denying that the grey substance conducts the sensitive impressions. Chauveau explains this discrepancy between Brown-Séquard's results and his own, by the supposition that Brown-Séquard has interpreted reflex motions as signs of pain. At the same time it will be observed, that our author is in accordance with the just named physiologist on a point of not less importance—viz., in asserting that our views regarding the posterior columns, as fulfilling the function of transmitting sensitive impressions to the brain, are entirely erroneous.

Kölliker gives the result of his experiments on the influence of various solutions and fluids on the irritability of the nerves of frogs. 1. In water, and in diluted solutions of the salts of alkalies, as also in those of various indifferent organic substances, as sugar, urea, and albumen, the nerves swell and lose their irritability within from one to three hours. 2. In solutions of these substances, of a certain degree of concentration, the nerves do not swell, and retain their irritability for a long time. 3. In still more concentrated solutions they shrink and die off more or less rapidly. 4. The degree of concentration keeping up the irritability longest varies in different salts. Thus culinary salt, in a solution of one-half per cent., preserves the irritability for twenty-five hours; in a solution of 9 per cent. for an hour. 5. The application of some salts, in solutions of a certain strength, causes convulsions, and even tetanus (culinary salt, in solutions of 4—5 per cent., convulsions; of 20—30 per cent., tetanus). 6. Nerves that have lost their irritability in water or weak solutions, regain it in stronger solutions. 7. Nerves deprived of irritability by stronger solutions regain it by the application of water and weak solutions. 8. Nerves allowed to become dry (a process accompanied by active contractions of the respective muscles), may, by means of water, be restored to irritability after having completely lost it. 9. The author concludes that the neurine is not possessed of high physiological importance, as even after its coagulation the irritability of the nerve-fibres may continue. He considers himself, therefore, entitled to the inference, that the axis-cylinder is the only conducting part of the nerve-fibre. He adduces, however, no decided proof that the neurine has been really coagulated in those fibres which retained their irritability.

While Haller, after numerous experiments, considered the *dura mater* as perfectly insensible, Flourens found it, in the normal state, likewise so, with the exception of dogs, in whom he found it sometimes to be possessed of sensibility; but in the state of irritation and inflammation, the latter author describes the dura mater as constantly highly sensitive, while the layer of the brain immediately underneath it remained completely insensible. In the same manner, Flourens infers from his experiments that the ligaments, the tendons, and the periosteum, are altogether insensible when in their normal state, but that they become very sensitive as soon as irritation or inflammation is set up in them. From these observations, Flourens is inclined to attribute to the dura mater, the tendons, ligaments, and periosteum, during the state of health, a *latent sensibility*, and to reject the view of the existence of any completely insensible organ in the animal body.

Samuel found in his experiments, performed on rabbits, dogs, and cats: 1st., That the hyperæmia of the intestinal mucous membrane, produced by the extirpation of the plexus cœliacus, is so great that it exceeds all pathological hyperæmias hitherto known, even that from cholera. By comparing this result with those of other experiments, the author considers himself entitled to assert, that this hyperæmia cannot be attributed to the peritonitis caused by the operation, the less so as it does not extend to the lower parts of the intestines. 2nd. That the secretion of the mucous membrane becomes increased by the extirpation of the plexus, but not to the same degree as this is the case in violent diarrhœa, and much less so than in cholera. The complication with peritonitis, the section of the ramifications of the pneumogastric nerves entering into the formation of the plexus, and the hyperæmia of the liver, may be considered as influences lessening the secretion.

The results of Iaschkowitz's experiments on the influence of section of the plexus lienalis on the structure of the spleen, are related under III. of the present Report.

VI. Sexual Phenomena.

Delafond: *On certain Physiological Phenomena connected with Parturition and Lactation in Bitches that have not been Fecundated when in Heat.* (L'Union Méd., tome xi. No. 61, 1857.)

Delafond directs the attention of the Académie de Médecine to several phenomena deserving further examination. He corroborates the observation made already by the great Harvey on doe-rabbits, and by Buffon on bitches, that the breasts of animals which have not been fecundated when in heat sometimes become turgescent, and secrete milk at the time when the parturition would take place if the animals had become pregnant. The author observed the commencement of the turgescence in bitches already two or three weeks before the term of the pregnancy would have been elapsed. In addition to this, the author witnessed, at the period when the parturition would have occurred, enlargement and swelling of the vulva, and increased viscous secretion of the mucous membrane of the vagina; he even saw the animal in a restless state arranging a resting-place, as if for an expected process of whelping; a few days later he discovered the symptoms of milk-fever, and the bitch in this state allowed a puppy placed underneath her to suck her breast, she bestowed on it the same signs of affection as if it had been her own, and the young animal was evidently thriving by the nourishment it thus received. Leblanc, Roche, and Moreau, who took part in the discussion on the subject, related observations of their own of a similar nature, and Roche mentioned that Dubois had met with analogous phenomena in women.

QUARTERLY REPORT ON PATHOLOGY AND MEDICINE.

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I. Affections of the Nervous System.

The Influence of Cerebral Disease upon Diabetes Mellitus. (L'Union Médicale, March 14th, 1857.)

In the Academy of Sciences, March 2nd, 1857, M. Leudet reports four cases which had fallen under his observation, and which tended to show that lesion of the brain may be productive of glycosuria.

CASE 1.—A female, aged thirty-two, in the sixth month of pregnancy, suddenly lost the sight of the left eye, without any other symptom of paralysis. Headache and vomiting supervened at the same time. Seven months and a half later there were sudden symptoms of coma, which lasted for a day, leaving paralysis of the third and fifth pairs of nerves of the left side, facial left-sided anæsthesia, great thirst, and general symptoms of diabetes. By the aid of Barreswill's test, the presence of sugar was proved in the urine. Under the use of iodide of potassium the paralysis diminished, and the diabetes disappeared. A temporary relapse in regard to the cerebral symptoms occurred five months later, when no sugar was discovered in the urine.

CASE 2.—A female, aged fifty-three, was suddenly seized with right-sided hemiplegia, depending upon cerebral lesion, and accompanied by epileptiform attacks; the power of motion was restored, particularly on the affected side; two years after these apoplectic seizures, diabetes manifested itself; there was sugar in the urine; a year later, albuminuria and a state of general cachexia set in.

CASE 3.—A female, aged eighty, was suddenly seized with hemiplegia of the left side; at the end of eighteen months she suffered from intense thirst, sugar was found in the urine by Moore's and Barreswill's tests; humid gangrene of the right foot and death followed.

CASE 4.—A female, aged thirty-nine, was seized at the sixth month of uterogestation with paraplegia and convulsions. These symptoms gradually disappeared; vertigo remained. Six years later there were frequent hæmorrhages, dyspepsia, and finally diabetes mellitus. Variola supervened, which proved fatal.

We think these cases fairly open to criticism, inasmuch as, with exception of the first case, the period intervening between the occurrence of cerebral symptoms and of the appearance of sugar in the urine, was so long as to justify a doubt as to the causal relation of the former. In the first case, the fact of sugar being discovered at the time of the first apoplectic seizure confirms the observation of M. Blot of its presence in the urine of all females under those circumstances, while its absence at the time of the relapse tends to prove that there was no relation between the glycosuria and the cerebral symptoms in the first instance. We have ourselves shown that in epilepsy the presence of glycosuria is at least an event of very rare occurrence, since in fourteen cases of epilepsy in which we have examined the urine for sugar, we have failed to discover it.

Clinical Studies and Observations on Cerebral Rheumatism. By DR. ADOLPHE GUBLER, Physician to the Beaujon Hospital, &c. (Archives Générales de Médecine, March, 1857.

It is well known that in by far the majority of cases of rheumatic fever accompanied by cerebral symptoms, delirium, mania, stupor, coma, or convulsions which prove fatal, no post-mortem lesion is found to indicate local disease within the cranium. Dr. Watson,* among others, goes fully into this question, and details some interesting cases, showing how this class of symptoms may be due solely to the sympathetic irritation of the encephalon. Dr. Gubler reopens the discussion; but although he states that "the reality of cerebral rheumatism must be considered as settled," we only find one case in which he is able to demonstrate the existence of meningitis. It occurred in an Englishwoman, aged thirty-two, who had had twelve children, and had before her admission into Beaujon (July 2nd, 1856) been subjected to great bodily fatigue and

* Lectures, vol. ii. p. 275.

mental anxiety. The immediate cause of the acute rheumatic affection had been a long walk, during which she had felt repeated shiverings when taking rest, a week previously. All the joints were swollen and painful; the patient was unable to make the least movement. The affected parts were red, and inflamed lymphatics could be traced along the skin. There was slight jaundice and enlarged liver; an impetiginoid eruption was seen on the legs. The aortic and mitral valves each presented a systolic soufflé; pulse 130, full and strong. No albumen in the urine. She was treated with quinine, one gramme (gr. xv.) during the day, in three doses, to which a small quantity of opium was added on the 3rd July. On the 4th, the first symptoms of cerebral excitement occurred. There was sub-delirium; speech short and anxious; the face flushed; the eyes brilliant; the pupils contracted; pulse 136. The souffle very loud and harsh; the joints the same. A venæsection, a blister to one leg, an "antispasmodic potion without opium," were ordered. Diarrhœa and delirium occurred during the day. The blood was much cupped and buffed; the serum yellow, coloured green on the addition of nitric acid. Twenty leeches were placed behind the ear. During the ensuing night the delirium and agitation were extreme. There were no irritable convulsions and no vomiting. The patient expired at six a.m.

We must refer the reader to the original for the interesting details of the examination of the joints and the external parts affected, which are given with much minuteness. In the chest, satisfactory evidence was found of endocarditis affecting especially the valvular tissues on the left side of the breast. Within the cranium, on the anterior part of the convex surface of the brain, a vivid redness was found, which was not removed by washing; the arachnoid and the pia mater at this point were strongly injected. The subjacent grey matter was softened, of a rose tint; under a stream of water it presented a velvety appearance. The lateral ventricles contained a reddish sanguinolent serum; the ventricular parietes were not softened. The choroid plexuses were infiltrated, and presented a large number of minute transparent vesicles. The liver was found enormously enlarged, "of the colour of beeswax, of firm consistency; when cut, the fibrous tissue was found hypertrophied. The microscope showed the parenchyma to consist of hepatic cells, distended and deformed by oil-globules; there was also free fat." The spleen was also enlarged to nearly double its normal size.

Professor Gubler terms the above morbid condition of the liver, "wax liver des Anglais;" and informs us at the same time that he has only once seen it among his compatriots. Our readers will probably agree with us that the above description in no way tallies with the microscopic features which we regard as constituting waxy liver. Dr. Gubler reports two other cases of articular rheumatism, in which cephalic symptoms were manifested; but as one recovered, and the other, although fatal, exhibited no trace of cerebral lesion, they only tend to confirm the prevailing opinion relative to the purely symptomatic character of the cephalic symptoms accompanying rheumatic fever.

On Partial Paralysis of the Extremities induced by the continued Use of Snuff containing Lead. By Dr. Moritz Meyer, of Berlin. (Virchow's Archiv, Band xi. Heft 3.)

Four interesting cases observed by the author are given in detail, in which the history and the symptoms justify the diagnosis of lead poisoning. The features characterizing the cases were—1. A more or less advanced paralysis of the extensors of the fore-arm; 2. A projection of the metacarpal bones; 3. A yellowish, sallow complexion. In three of the cases, repeated attacks of colic had preceded the appearance of the paralysis; in one, it was absent. In

three cases, the extensores digitorum communes, and in one, the deltoid muscles, had suffered chiefly. The presence of lead in the tobacco used by each patient was proved chemically. A large number of other kinds of snuff besides those used by the above-named patients were analysed, and all that had been packed in lead were found to be more or less impregnated with lead or oxide of lead, the amount of impregnation varying from 0·78 to 1·78 per cent.

II. Affections of the Thoracic Viscera.

Memoranda of a New Method of Measuring the Thorax. By Dr. Woillez. (Archives Générales, p. 583, May, 1857.)

The author has presented to the Academy of Medicine a new instrument for measuring the thorax, which he terms a cyrtometre, with which he avers that he can at once determine the modifications of certain diameters, and of the circular outline of the thorax. He is of opinion that the method of mensuration hitherto pursued is erroneous, because based upon two false principles; the one being the supposition that the healthy side presents an uniform capacity, while the diseased side alone is regarded as susceptible of modification, the other being the opinion that mensuration is a means of diagnosis in the strict sense of the word. The instrument consists of joints of whalebone of two centimetres each, moveable in such a way that when applied to any surface the whole may take and retain the curve of that part. The outline of the curve of the thorax thus obtained being transferred to paper, the comparison of curves, taken at different periods of the malady, aids to determine the successive changes in the affected part. Without diagrams, it would be useless to go more into detail.

On Redness of the Cheeks as a Symptom of Pneumonia. By Adolphe Gubler. (L'Union Médicale, No. 23, April 28, and May 2, 1857.)

Dr. Gubler takes up the old doctrine that the redness of a cheek in a case of pneumonia indicates the side on which the disease lies. Modern authors have paid little attention to the subject, but Dr. Gubler has satisfied himself, by extensive observation in the Salpêtrières, that the general law is true. The author has guarded against the fallacy which might result from the patient lying on the cheek presenting the greater redness, and has measured the relative temperature of the two sides of the face with the thermometer. Numerous cases are detailed, and the following is the summary of his observations: 1. The redness of the cheeks which commonly coincides with pulmonary inflammation, is not, as is commonly thought, a fortuitous circumstance, but a functional disturbance bearing a definite relation to the disturbance of the respiratory passages. 2. This redness is not necessarily proportioned to the extent and degree of the anatomical lesion, but bears a relation to the intensity and progress of the inflammatory action. 3. A sensible, and sometimes considerable elevation of temperature (from 0·50° to 5·40° Cent., or nearly 1° to 10° F.) accompanies the hyperæmia, and gives it the character of active congestion. 4. The congested cheek corresponds to the lung which is the seat of phlegmasia, or the one which is most affected. 5. The flushed cheek is seen, not only in pneumonia, but also in the majority of other pulmonary inflammations—in those which accompany tuberculization, as in typhoid pneumonia, and even in capillary bronchitis. It appears to be most marked in pneumonia of the apices —a circumstance already pointed out by Bouillaud.* 6. The production

* Nosographie Médicale, tom. xi. p. 484.

of other morbid conditions may be promoted by the habitual hyperæmia of the face; thus a spot of erysipelas has been seen developed on the cheek of the affected side. 7. The redness of the cheeks in acute diseases of the lung may be explained by the stimulation of their nervous plexuses extending to the brain, and reflected upon the respiratory nerves of the face. 8. The phenomenon may be regarded as a manifest example of sympathy established between two distant regions by the agency of the nervous system.

On Extravasation of Blood in the Tissue of the Valves of the Heart. By Prof. H. Luschka, in Tübingen. (Archiv für Pathol. Anatomie, &c., Band xi. Heft. 2.)

Prof. Luschka, in 1852,* discovered the existence of bloodvessels between the layers of the endocardium, or the valves. His researches led him to conclude, that "the exudations or fibrinous vegetations observed on the surface of the valves in endocarditis is dependent on an hyperæmic condition of these vessels, accompanied by exudation of lymph from them." He now considers the formation of small extravasations which occur in the tissue of the valves in consequence of the rupture of these vessels. The Professor has but rarely met with such ecchymosis in the heart of adults; he found one near the free edge of the anterior curtain of the tricuspid in a man aged eighteen, and another in the same subject in the anterior flap of the aortic valves. A well-defined ecchymosis occurred in the left flap of the aortic valves near its insertion, and an extravasation was observed on one of the larger tendons of the mitral in a female who died of pneumonia. Dr. Reuss is quoted as having seen an ecchymosis within a fold of the pulmonary valve. Dr. Luschka has much more frequently met with hæmorrhage in the tissues of the valves of new-born infants. The extravasations almost always occur in the vicinity of the free margin of the mitral and tricuspid valves. They are chiefly visible on the inner layer, and generally cause the surface to project somewhat. They are generally circular, and look like red granules scattered through the tissue, varying in size from that of a poppy seed to that of a millet seed. They are rarely solitary, but more frequently there are from three to six. Their colour is yellowish red, or blackish red, or even absolutely black. When quite recent, we may detect in them blood-corpuscles and *débris* of tissue. In those that offer a reddish yellow hue, amber-coloured molecules of pigment, decomposing blood-corpuscles, and oil-globules are never absent; and in the black spot, which is probably of older date, doubtless granular black pigment is found in considerable quantity.

These extravasations appear to be of very frequent occurrence in the new-born infant. They were met with 41 times in 165 post-mortems—viz.,

13	times	in the	tricuspid valve.
8	,,	,,	mitral valve.
17	,,	,,	tricuspid and mitral valves.
2	,,	,,	tricuspid, mitral, and pulmonary valves.
1	,,	,,	mitral and pulmonary valves.

Of the 165 children, 128 were born alive; 37 were stillborn. Of the former, 31, of the latter, 10, exhibited these ecchymoses.

* Archiv für Path. Anat., p. 182. 1852; and British and Foreign Medico-Chirurgical Review, p. 254. July, 1853.

On the Relations of Bright's Disease and Cardiac Affections. By H. BAMBERGER, Professor of Medicine in Würzburg. (Archiv für Pathol. Anat. und Physiol., Band xi. Heft 1.)

The well-known frequency* of the complication of Bright's disease and valvular disease has been differently accounted for by different authors. An essential question regarding the etiology of the two classes of affections is, which of them precedes the other? Prof. Bamberger states that, with the exception of a small number of cases in which, during the course of Bright's disease, endocarditis took place, he has never seen a case in which the renal affection was the first; whereas he has observed many in which morbus Brightii was developed during the existence of valvular disease. He therefore concludes that valvular disease is a frequent cause of Bright's disease, but admits that the latter, under these circumstances, frequently does not pass beyond the first stages.

The author next considers the relation of hypertrophy of the heart, unaccompanied by valvular affections, to Bright's disease. The ratio appears to be above 20 per cent. of the former; Dr. Bright himself estimated the frequency of cardiac hypertrophy at 23 per cent. Dr. Bamberger is of opinion that the mechanical explanation ordinarily offered, according to which the hypertrophy is produced by the physical influence of the derangement in the circulating fluid, is untenable. He admits that hypertrophy of the heart, in the majority of instances, is secondary to the renal affection; but he shows that it is found with large kidneys and contracted kidneys, and argues that a very different effect upon the momentum of the aortic current must be produced by each of these forms of renal disease. The Professor remarks, that if the obliteration of some renal capillaries could exert so palpable an influence upon the heart as that observed to accompany many cases of contracted and granular kidneys, the obliteration or application of a ligature to any larger artery ought to produce the same result. He points out that granular liver is analogous to granular kidney, and yet is not productive of cardiac hypertrophy.

In order to arrive at a solution of the question as to the efficient cause of the cardiac hypertrophy in these cases, he carefully tabulates and analyses 48 cases of Bright's disease observed by himself during life, in which post-mortem examinations were made. In these 48 cases there were 25 in which there were marked alterations in the heart; in 15 there was either recent, or traces of former, pericarditis; in 10, fatty degeneration; in 4, degeneration of the aorta; in 3, the remains of endocarditis. Hypertrophy and dilatation of one or more cardiac divisions were met with 19 times. In 28 cases there was serious disease in the lungs; 11 times tubercle, 10 times pneumonia, pleurisy 9 times, emphysema 3 times; the spleen was enlarged in 24 cases; the liver was cirrhosed 3 times, in a state of adipose or bacony enlargement 16 times.

It is manifest that serious derangement occurs in most of the vital organs as a complication of Bright's disease. The author concludes that the hypertrophy of the heart is therefore not explicable on purely physical grounds; but that it must be regarded as a purely "vital phenomenon," belonging to the same category as so many other derangements of nutrition which are developed in the course of Bright's disease.

Contribution to the Pathology of Heart Disease. By W. O. MARKHAM, M.D. (British Medical Journal, April 4th, 1857.)

An interesting case is detailed by the author, of a child aged four years, who during life had presented "a rough, loud, systolic bruit, which was audible all

* Willigk (Prager Vierteljahrsschrift, Band xxxviii. p. 44) shows that in 209 cases of Bright's disease, valvular disease was present in 31, or about 15 per cent. See also Chambers, Decennium Pathologicum, who establishes a much higher ratio.

along the base of the heart, and in the whole of the left subclavicular region; it was indistinctly heard below the nipple, and was scarcely audible at the heart's apex; its point of greatest intensity was to the left of the upper part of the sternum; it was not audible up the right edge of the sternum, along the course of the aorta." There were slight traces of cyanosis before death, when febrile symptoms, with chronic twitchings of the arms, strong beatings of the heart, drowsiness, and other indications of cerebral disturbance, supervened. Although at one time pulmonary tubercle was suspected, the auscultatory evidence of its presence was unsatisfactory. All the symptoms before death indicated an acute affection of the heart. This organ, however, presented "neither externally nor internally the slightest trace of inflammation, nor was there, as far as the eye could judge, any deviation from their normal condition observable in any of the valves, or of the orifices of the organ. There was neither constriction of the orifices, nor of the roots of the great vessels, nor any defect in the valvular apparatus. In all respects the heart appeared healthy and normal, excepting one, and this was in an open condition of the foramen ovale. The foramen ovale, though largely open, so as to permit the point of a finger to pass from the right into the left auricle, was partially closed on the left side of the septum by a peculiar adjustment of the membranous valve;" the membrane being attached above and below, so as to present two narrow semilunar slits, one on either side of the valve. Both lungs were studded with miliary tubercles. It is stated that the heart, having been submitted at the Pathological Society to some of our most distinguished cardiac pathologists, who were unable to detect any other lesion than the open foramen ovale, it is a fair inference that the bruit was due to the latter condition.

The case is an important contribution to our knowledge of heart disease, and to the auscultation of the organ, inasmuch as it meets the chief objection to the production of a bruit by an open foramen ovale, that hitherto where a murmur has been found in connexion with this lesion, there has also been a constriction of the pulmonary orifices.

A Peculiar Cavernous Degeneration of the Muscular Tissue of the Heart. By Dr. C. Skrzeczka. (Archiv fur Pathol. Anat. und Physiol., Band xi. Heft 2.)

A strong-built man, aged twenty-one, who had always enjoyed good health, was pursued by a boy of twelve, seized, and thrown down. At the same moment he breathed hard once or twice, and expired. The heart was found of average size. The parietal and visceral layer of the pericardium entirely adherent, chalky deposits intervening between them in the form of hard laminæ. A section of the left ventricle, at the left margin of the heart, presented the appearance of the section of a fine sponge. Small cavities, varying in size from a pin's head to a small bean, lay closely aggregated together, yellowish-brown muscular tissue intervening. The larger ones lay externally, the largest immediately beneath the pericardium. Some of the latter were subdivided into several compartments by fine membranous or thready expansions, stretched across from one side to the other. When the heart was examined by Dr. Skrzeczka, it had lain in spirit some time. The cavities were found full of spirit, excepting one, which lay immediately under the pericardium, and contained some coagulated blood. The cavities had no lining membrane, but appeared to be mere lacunæ in the muscular texture. The whole left ventricle exhibited the same degeneration, as did also the septum. The right ventricle was partly affected in the same way, and the papillary muscles of the left ventricle showed traces of the same condition. The valves were all normal; the arteries showed no atheroma, and the coronary arteries were normal.

The muscular tissues throughout exhibited fatty degeneration in an advanced degree.

The author has in vain sought for an analogous case in the records of medicine. He considers that the cavities cannot be regarded as cysts, as the remains of apoplectic foci, or as the residues of abscesses: The only explanation of the condition which he offers as at all compatible with the history and post-mortem appearances of the case, is that the cavities were the result of absorption of parts which had previously undergone complete fatty degeneration.

III. Affections of the Blood and disordered Secretions.

The Constitution of the Blood in Syphilis. (L'Union Médicale, May 16, 1857.)

In the eighth lecture on chancre recently delivered by M. Ricord, we find the following interesting contribution to hæmatology, in the shape of a series of analyses of the blood of syphilitic patients, by M. Grassi, *pharmacien-en-chef* of the Hôtel Dieu:

I. *Blood of Patients affected with Simple Chancres.*

	1st patient.	2nd patient.	3rd patient.	4th patient.	5th patient.
Water	762·4	762·4	768·0	763·8	750·0
Fibrin	2·9	2·9	3·0	2·6	3·9
Albumen	94·3	94·3	88·5	95·5	112·5
Corpuscles	140·4	140·4	140·5	138·1	133·6
	1000·0	1000·0	1000·0	1000·0	1000·0

	6th patient.	7th patient.	8th patient.	9th patient.
Water	755·2	758·5	749·1	760·9
Fibrin	4·0	3·6	3·0	3·0
Albumen	113·7	84·3	109·0	97·0
Corpuscles	127·1	153·6	138·0	139·1
	1000·0	1000·0	1000·0	1000·0

These analyses show that in simple chancre the blood presents no material deviation from its physiological condition. The following cases seem to prove that in indurated chancre and secondary syphilis there is uniformly a diminution of blood-corpuscles and an increase in the amount of albumen, but no perceptible variation in the quantity of fibrin:

II. *Blood of Patients affected with Indurated Chancres.*

	1. Indurated chancre.		2. Indurated chancre.		
	First bleeding.	Second bleeding, after a month's treatment by iodide of potassium.	First bleeding.	Second bleeding, after a week's treatment by iodide of potassium.	Third bleeding, after a month's treatment by iodide of potassium.
Water	796·6	774·2	797·0	794·6	784·0
Fibrin	3·0	3·3	3·0	3·5	3·5
Albumen	104·5	113·5	106·0	95·2	84·0
Corpuscles	95·9	109·0	94·0	106·7	128·5
	1000·0	1000·0	1000·0	1000·0	1000·0

3. Indurated chancre. 4. Indurated chancre and roseola.

	3. First bleeding.	3. Second bleeding, after 20 days' treatment by iodide of potassium.	4. First bleeding.	4. Second bleeding, after 25 days' treatment by iodide of mercury.
Water	797·3	768·6	769·7	765·0
Fibrin	2·4	2·4	2·6	3·5
Albumen	123·9	87·0	102·6	106·0
Corpuscles	76·4	142·0	125·1	125·5
	1000·0	1000·0	1000·0	1000·0

5. Indurated chancre, syphilides. 6. Indurated chancre.

	5. First bleeding.	5. Second bleeding, after 8 days' treatment by iodide of mercury.	6. First bleeding.	6. Second bleeding, after 19 days' treatment by iodide of potassium.	6. Third bleeding, after 28 days' treatment by iodide of potassium.
Water	769·5	784·4	789·5	768·7	796·9
Fibrin	3·1	3·6	4·7	3·8	3·5
Albumen	102·6	89·7	115·4	121·0	68·0
Corpuscles	124·8	122·3	90·4	106·5	131·6
	1000·0	1000·0	1000·0	1000·0	1000·0

In the following three cases the reduction of the quantity of corpuscles is remarkably great:

7. Indurated chancre and roseola. 8. Indurated chancre. 9. Indurated chancre, with syphilitic spots.

	7. First bleeding.	7. Second bleeding, after 12 days' treatment.	8.	9.
Water	830·7	759·5	815·1	821·2
Fibrin	2·4	2·5	3·2	3·0
Albumen	108·0	110·5	126·7	127·5
Corpuscles	58·0	127·5	55·0	48·3
	1000·0	1000·0	1000·0	1000·0

In all the cases examined the outbreak of syphilis was recent, the above results must not therefore be regarded as representing the state of the blood in the later stages of the disease.

On Spanæmia, Chlorosis, and Analogous Conditions, as the predominant Characteristic of the present Age. By Dr. Pollitzer, Director of the first Chilorms Hospital in Vienna. (Zeitschr. der K. K. Gesellsch. der Aerzte, February, 1857.)

Dr. Pollitzer takes a very gloomy view of the condition of the human race at the present time, and considers it to be an established fact that the physical deterioration in Europe is profound, "a sad memorial of civilization." He admits the general diminution of mortality in all civilized countries, but affirms this to be a fallacious test, as there is not a corresponding increase in the health and vigour of the race, or in the number and character of the diseases. The reduction of the mortality, the author attributes to the increase of hospitals and similar charitable institutions,—to quarantine, vaccination, and numerous sanitary regulations. The boundaries of health and disease, he observes, are daily becoming less marked, and he considers it characteristic of modern pathology to affirm that there are numerous conditions which are undoubted deviations from the healthy standard, though it is impossible to

delineate or give definite portraits of them, because they make their appearance during a state of "relative health." The physician has no name for the disease, but the patient maintains that, not feeling in health, he has no alternative but to call himself ill. This anomalous condition, Dr. Pollitzer accounts for by the spanæmia and chlorosis, which he regards as the feature peculiar to our times—the soil in which the feebleness and deterioration of our race take root. After developing his views more in detail, the author proceeds to show how these conditions are fostered by modern civilization. A constant stretch of the mental powers,—a restless excitement of the passions,—a perpetual struggle for advancement,—the fresh wants of every day, science and the arts themselves being subservient even to the luxury and demoralization of the times,—the destruction of all moral harmony and peace,—are advanced by Dr. Pollitzer as the evils of modern civilization. And these evils react especially upon the younger generation; and the demands made upon the youth of eighteen or twenty, of the present, would formerly have been considered a sufficient tax for the strength of a man of upwards of five and twenty. He inveighs especially against the polymathy (if we may coin the word) of children, among whom the spanæmia and chlorosis of the age especially flourish.

Having for seventeen years devoted himself to the study of children's diseases, he has arrived at the conclusion that the features which characterize our age have their source in the treatment of childhood, and that the deterioration of the race at large takes its origin in that of childhood.

The facts upon which Dr. Pollitzer bases his remarks are, that anæmia and chlorosis occur alone, or associated with rickets, hypertrophy of the lymphatic glands, and of the spleen and liver, to an incredible extent, even from the first month of life. Of 1000 children that were treated in the children's hospital, on an average 700—800, or from 70—80 per cent., were thus affected. He also observed that the anomalies of the blood and constitution, which are so widely diffused, invariably appear where the nutrition of the child has been imperfectly effected. The stomach and intestinal tract are the parts that first suffer, hence it is in these organs that we discover the prevailing morbid conditions of childhood; and while they materially influence the mortality of children they equally affect the state of their future health when they survive childhood.

An Investigation of the Urine in Remittent and Intermittent Fevers, proving the Hyperphosphatic state of the Blood; also the eliminating Properties of Quinine. By H. M. Stuart, M.D., of Beaufort, South Carolina. (Charleston Medical Journal and Review, May, 1857.)

On a Physiological Action of the Disulphate of Quina. By H. Ranke, M.D. (Medical Times and Gazette, May 30th, 1857.)

The observations and experiments of Drs. Ranke and Stuart appear to directly contradict one another, inasmuch as the former shows that, in health, at least, the effect of the disulphate of quina is to diminish materially the quantity of uric acid excreted by the kidneys; while the latter demonstrates, that in intermittent and remittent fevers the administration of quina induces an increased excretion of uric acid, urate of soda, biliary matter and mucus, and triple phosphates. Dr. Stuart's essay has received the College Premium at the commencement of the Medical College of South Carolina, and therefore comes before us with a special claim upon our attention. We will examine his paper first, premising that his determination of the salts and other deposits of the urine was made with the urinometer and the microscope; the different elements were not isolated, nor was the balance employed, as in the experiments by Dr. Ranke.

Four cases of remittent, three of intermittent, fever were examined by Dr. Stuart. The accounts are very scanty, but in all the urinary salts appear to

have been increased during the administration of the quinine. We select the two best cases as illustrations:

"Roper Hospital, Bed No. 6.—Remittent. June 21st, admitted. Urine examined before medicine had been given. Sp. gr. 1·037; colour high; slight sediment, consisting of urate of soda, uric acid, and biliary matter. Quinine (grs. x. and v.) given, seven hours after which urine was examined. Heavy deposit of triple phosphates, uric acid in small crystals, colouring matter, and a little mucus.—June 22nd: Sp. gr. 1·040; high colour; more uric acid than on 21st; triple phosphates in same proportion; other things as on 21st.—June 24th: No fever; sp. gr. 1·055; colour very dark, and very heavy sediments of phosphate of lime and uric acid. Quinine (grs. x. and v.) given.—June 25th: Sp. gr. 1·040; colour high; ammoniaco-magnesian phosphates in very large crystals, but not so abundant; other things the same. Quinine (grs. x. and v.) given.—June 26th: Sp. gr. 1·050; colour high; triple phosphates in large quantities; uric acid, &c., in same proportion. The sp. gr. of this patient's urine before leaving the hospital had fallen to 1·030, and it began to appear natural.

"Roper Hospital, Bed No. 14.—Intermittent. June 28th, admitted. Before quinine was given, nothing unusual under the microscope. Sp. gr. 1·040; sediment scarcely perceptible, consisting of a little uric acid; colour rather dark. Quinine given (grs. x. and v.).—June 29th: Sp. gr. 1·050; very heavy sediment of urate of soda, and the triple phosphates; uric acid; colour very high. Quinine given (grs. x.) during day. No fever.—June 30th: Sp. gr. 1·056; colour high; sediment even greater than on the 29th; the triple phosphates increased both in size and quantity; uric acid also in large quantity. Repeated quinine. This patient's urine quickly fell to the normal standard, and he recovered speedily."

Dr. Ranke's experiments were made upon himself and two medical volunteers. The urine was tested only for uric acid, which was determined by mixing 100 cubic centimetres of urine with concentrated hydrochloric acid, and allowing it to stand for forty-eight hours. The uric acid was carefully collected on a filter, well washed, and weighed.

Dr. Ranke found that on a mixed diet his average secretion of uric acid (deduced from twenty analyses) is 0·629 grammes in twenty-four hours. In the first experiment he took twenty grs. of disulphate of quina in twenty-four hours, and during the next forty-eight hours he passed 0·542 grammes, or 0·271 grammes for twenty-four hours. The second experiment gave a similar result, the quantity of uric acid excreted during forty-eight hours, after fifteen grs. of quina had been taken, being equal to 0·790, or 0·395 in twenty-four hours. On the third day after quina had been taken, Dr. Ranke again excreted about his normal average—viz., 0·621 grammes; and on the two following days, 0·543 and 0·656 grammes respectively. He now took quinine for a third time, and the quantity of uric acid again fell to 0·438 grammes on the first, and 0·392 grammes on the second day.

Dr. S. passed 0·544 and 0·543 grammes of uric acid respectively on two days before the experiment. He then took two ten-grain doses of quina, and on that day excreted 0·376 grammes of uric acid; the next day he took grs. v. of quina, and the quantity of uric acid fell to 0·317 grammes; on the three following days he passed respectively 0·483, 0·450, and 0·654 grammes.

Dr. M., on four days before taking quina, passed 0·662, 0·774, 0·585, and again 0·585 grammes; he then took ten grs. of quina, and on that day excreted 0·358, on the next 0·387, and on the third 0·670 grammes of uric acid; it then remained stationary.

Dr. Ranke, in two of the experiments, determined the other constituents of the urine, and found the solids in general, and the urea, not materially affected by the quina, but the phosphoric acid appeared to be augmented.

On the Abnormal Presence of Urea in the Pancreatic Juice in Man. By Dr. F. Hoppe. (Archiv für Pathol. Anat. und Physiol., Band xi. Heft 1.)

In a man who died with icterus in the Charité, at Berlin, the gall-bladder and the larger bile-ducts in the liver were found distended with bile, and the pancreatic duct was cylindrically dilated, and many of its branches in the gland converted into ampullæ of the size of hazel-nuts. A dense cicatricial tissue which surrounded the orifices of both ducts in the duodenum was the cause of the arrest of the two secretions. The pancreatic fluid was collected without the admixture of the smallest quantity of blood, and analysed with the following result:

	Grammes.		Per cent.
Urea	0·007	...	0·12
Fatty matter	0·001	...	0·02
Alcoholic extract	0·049	...	0·87
Watery extract	0·030	...	0·53
Insoluble residue	0·028	...	0·49
Inorganic salts	0·032	...	0·57
Total solid residue	0·147	...	2·60
Water	5·508	...	97·40
	5·655	...	100·00

On evaporation of the ethereal extract, excepting a trace of fat and a few microscopic globules of leucin, nothing but crystals of urea were observed.

The author remarks that the case proves that we need not fear the excessive liability of the urea to become decomposed in the blood and other fluids of the body, as so much urea was discovered, and not even a trace of ammoniacal salts.

IV. Sundries.

On the Existence of Herpes in Domestic Animals, and its Communication to Man. By Dr. Von Bärensprung. (Annalen des Charité Krankenhauses, Achter Jahrgang, Heft 1.)

The author quotes numerous writers who have directed attention to the occurrence in animals of cutaneous eruptions similar to those found in man. Alibert has remarked the occurrence of herpes circinnatus in horses; Dr. Fehr has observed a peculiar herpetic eruption in Switzerland communicated from cattle to human beings; similar observations are quoted from Hering's 'Repertorium der Thier Heilkunde,' Band i. 1840; from Gurlt and Hertwig's 'Magazin für die Gesammte Thierheilkunde,' Band vii. 1841; Letenneur's 'Réflexions sur l'Herpès Tonsurant,' 1852; and other works. From his previous investigations into the nature of herpes in man, Dr. Von Bärensprung assumed that the eruption in question was characterized in animals as well, by the formation of a confervoid growth. In them it resembles the herpes tonsurans of man; circular, well-defined spots form, upon which the hairs are partly broken off, partly fallen out, and invested with a white asbestine scurf; the subjacent surface is red, and covered with papulæ. These spots occur in all parts of the body, but especially in those which the animal is unable to reach with its tongue. Each hair is enveloped at its base with a thin whitish sheath, a prolongation of the sheath of the root of the hair, which commonly ceases at the point at which the hair issues from the cutis. This occurrence is due to a cryptogamic vegetation, which glues the sheath to the hair; this con-

sists in sporules and filaments; the former are circular or angular, and without granular contents; the latter are elongated, branched, and jointed. The characters are the same as those found in herpes as contradistinguished from tinea and chloasmi; but the cryptogamæ are found not so much, as in man, in the hairs themselves, as between the hair and the sheath. Dr. Von Bärensprung rubbed some scales containing much of the confervoid growth on his left fore-arm. For some days no effect was produced, but after a time considerable itching reminded him of the experiment, and to his surprise he found a well-formed spot of herpes circinnatus of the size of a sixpence. This gradually increased, and in three weeks attained to the size of a crown-piece. In the fourth week the first spot began to heal, but others formed in the vicinity, and the author now arrested them by the application of white precipitate ointment.

QUARTERLY REPORT ON SURGERY.

By John Chatto, Esq., M.R.C.S.E., London.

I. *On Foreign Bodies introduced into the Bladder.* By M. Denucé. (Moniteur des Hôpitaux, 1856. Nos. 126, 7, and 8.)

In this paper, M. Denucé, of Bordeaux, relates a case that occurred to himself, in the person of a woman who had introduced the handle of a stiletto into the bladder. After several days of severe suffering, she came to the hospital, and as the urethra was found to be in a very dilated state, the extraction of the foreign body was easily accomplished, by means of a polypus forceps passed along the index finger.

M. Denucé has collected the particulars of 391 published cases, and the enumeration he gives of the bodies in question is both curious and useful. In 78 they were portions of catheters or lithotrity instruments—viz., 15 metallic catheters, 9 gum elastic catheters, 7 gutta percha catheters (a large proportion, considering the short time these dangerous instruments have been in use), 28 catheters (their nature not being specified), 16 bougies, and 3 branches of *brise-pierres.* Then we have 82 needles, pins, or tags, 1 stiletto, 1 crotchet needle, 6 bone or ivory needles, 6 ear picks, 3 ivory whistles, 1 ivory spindle, 1 ivory stiletto handle, 15 leaden balls, 3 small keys, and 8 instances of metallic fragments of various kinds. In 12 bones or splinters of bone, in 10 pebbles or china, 6 penholders, 15 needle-cases, 10 pieces of tobacco-pipe, 4 portions of glass tubes. In 21 instances fragments of wood, as 3 pencils, 1 piece of a match, 1 ramrod, 1 mustard-spoon handle, &c. In 34 there were fragments of plants, as ears of corn, stalks, &c.; in 26, fruits or kernels; in 4, tents of charpie, 1 strip of linen, 1 skein of cotton, 3 *débris* of cotton or wool, 2 pieces of cord, 4 portions of wax candle, 3 pens, 1 piece of whalebone, 2 leather boot-laces, 1 piece of tendon, 2 *débris* of fæcal matter, 1 pessary, 1 shell, 14 instances of various fœtal *débris,* 6 locks of hair, 2 of larvæ of insects, and in 1 pills.

If we abstract from this curious list the bodies which have obtained accidental entrance into the bladder, whether from clumsy surgical manœuvres, or communications established through the walls of the bladder, either externally (as in the case of balls and wounds), or with the rectum, vagina, or ovary, there will still remain 258 cases in which no legitimate explanations can be given of the presence of these bodies. Those assigned by the patient are usually as singular as are the bodies themselves; some being said to find their way there while attempting self-catheterism, others from the patient having fallen on them, while others again are stated to have been swallowed. The true and principal cause of their introduction, when not accidental, is to be sought in the vagaries

of an abandoned depravity. Of these 256 cases, 119 are stated as having been males, and 96 females, while in 41 instances the sex is not indicated. In 14 instances they occurred in children from the age of a few weeks to fifteen years.

After a foreign body introduced into the urethra has become propelled into the bladder, in a few days it begins to be covered with incrustations. At the end of some weeks, these have attained a considerable thickness; while at the end of some months, true calculi may be constituted. The form of the body, however, exerts considerable influence upon the mode of deposit. In rounded or short bodies the incrustation becomes general, while in those which are elongated, it takes place especially towards the middle. Thus, in most cases in which calculi have been formed on needles, the ends of these are found projecting beyond the deposit; and it is such calculi that especially give rise to cystitis and other dangerous accidents.

Among the 391 cases collected by M. Denucé, in 21 death took place independently of any operation. In 13 of these the affection was recognised at the autopsy; but it is not stated with precision whether the vesical affection was the cause of death; in 2 death resulted from the *débris* of a fœtus passing into the bladder; and in 6 it was the direct result of the introduction of the foreign body. These last were examples in which the points of pins or needles became imbedded in the walls of the bladder, giving rise to intense and fatal cystitis. Cases in which art does not intervene do not, however, always terminate thus, the efforts of nature in some sufficing to liberate the economy from their presence. Thus they may be carried out by the urine, especially when the bodies are small and women are the subjects. In 31 instances in which the age is specified, this occurred in 14 men and 17 women. Occasionally, certain bodies, such as broken needles, escape by penetration of tissue, and this is stated to have occurred in four cases.

As in the great majority of instances nature will not be able to secure the discharge of these bodies, the surgeon, in order to prevent the occurrence of dangerous accidents, must interfere, endeavouring first to secure their removal by extraction, and if unsuccessful, resorting to lithotomy. In the cases here collected, lithotomy has been had recourse to 125 times—viz., in males, perineal lithotomy, 87 times; recto-vesical, 2; hypogastric, 2: and in females, urethro-vaginal lithotomy in 22, and hypogastric in 12. Unfortunately, in only 61 of these cases has the ultimate result been stated. In 39 occurring in males, perineal lithotomy was performed in 36 (31 recoveries and 5 deaths), hypogastric in 2 (both recoveries), and recto-vesical in 1 (fatal). In the 22 cases occurring in females, there were 15 urethral or vaginal operations (13 recoveries and 2 deaths) and 7 hypogastric (5 deaths and 2 recoveries). On the whole number, therefore, 48 recoveries and 13 deaths. The hypogastric operation has thus proved very fatal, 5 deaths taking place to 4 recoveries; and in the latter, in two instances the operation consisted simply in enlarging an aperture already existing.

The performance of the operation may be rendered difficult by the nature of the bodies to be removed. Thus, their softness may be such as to render their recognition and removal difficult; the length of others may lead to their being seized in the middle, and brought across the aperture; while, if they have remained long in the bladder, the size and irregularity of the incrustations present additional obstacles. The precision of measurement attainable by lithotrity instruments, however, now comes to our aid. As to the particular operation indicated, it may be stated in a general way that the perineal operation in men, and the urethral in women, suffice for small bodies, or for such as are thin and elongated; those which are of larger size require the bilateral or vaginal operation; while the hypogastric, seeing its unfavourable results, should be reserved for quite exceptional cases. It must be remembered, how-

ever, that in women the urethral operation is almost always followed by incontinence of urine, and the vaginal by vesico-vaginal fistula.

Extraction of the foreign bodies has been performed in 112 of these cases, death following in 3. In reference to the influence which the introduction of lithotrity has exerted upon the improvement of extracting instruments, M. Denucé makes the following calculation:—Of the whole 239 cases in which interference has taken place, 127 occurred prior to, 122 subsequent to, 1830, when lithotrity may be considered to have generally established itself as an operation. In the early series, lithotomy was practised 100 times, and extraction 27 times only; while in the latter series, it was resorted to but 21 times, and extraction 101 times. Thus, formerly lithotomy, with its mortality of 15 per 100 was the rule; while now, extraction, with 3 deaths in 112 cases, is the rule, and lithotomy the exception. The progress that has been made is still more apparent when we consider the case of the male urethra, with its long, narrow, sinuous canal. Of 20 cases of extraction noted prior to 1830, 16 occurred in women, and but 4 in men; while of 73 since that epoch, in which the sex is indicated, 46 occurred in males, and 27 in females.

II. *On the Treatment of Hydrocele in Children.* By M. Richard. (Gazette des Hôpitaux, 1857, No. 41.)

M. Richard, while attending for M. Guersant at the Hôpital des Enfans, met with no less than twelve cases of this affection in the course of one month; and although accident may have led to this accumulation, he yet believes that it is of more common occurrence than is usually supposed.

The hydrocele of children is commonly termed congenital, and as in the great majority of cases the vaginalis communicates with the peritoneum, *congenital persistence* seems to be one of the conditions of the disease. Not that all these serous collections can be reduced by the hand, for it is more common to find them irreducible; but nearly all of them, if watched sufficiently long, are found appearing and disappearing, increasing and diminishing, from time to time. Of these 12 cases, 2 only were purely funicular, the 10 others invading the scrotum and cord. The cysts of the cord, which often simulate a third testis, are in children and adolescents developed in the funicular portion of the persistent vaginalis; while in the adults we observe cysts of the epididymis, containing a turbid fluid and spermatozoa.

Experience has shown that in the treatment of these hydroceles, the persistence of the communication with the peritoneum is not of the importance that might have been expected. M. Richard's cases are treated in the following manner:—1. The liquid is evacuated to the last drop by means of a short exploratory trocar, of very small calibre. 2. An assistant exerts compression upon the lower part of the belly and the track of the inguinal canal. 3. From six to seven grammes of alcohol (40° of Beaumé's areometer) is then thrown in. 4. The canula is suddenly withdrawn so as to leave the fluid in the sac; and after continuing compression over the inguinal canal for a minute, the operation is concluded. "The consequences are very simple. The tumour increases a little towards evening, becomes a little painful next day, after when all pain entirely ceases. From the tenth to the fifteenth day the tumour entirely disappears, and the child is cured. If he is of an age to admit of it, he is allowed to walk or play about after the operation. Sometimes at the instant of withdrawing the canula, owing to the strong contraction of the cremaster and dartos, a little of the injected fluid is expelled, the little patient being at the same time seized with erection, or even expelling his fæces. But this is of no consequence. Sometimes, however, a few drops of the fluid enter between the skin and the vaginalis. This is followed by redness of the skin,

and the formation of a small abscess, which bursts of its own accord without interfering with the progress of the cure. The *smallest possible trocar* must be employed in this delicate operation, although without practice such an instrument is more difficult to use. We must render the hydrocele very tense with the left hand, isolating it as much as possible, and holding the trocar in the right hand, apply the pulp of the thumb and the index finger very near the pointed extremity of the instrument. In place of thrusting this in, as in the adult, we must insinuate its point as if using a bistoury. When the cure has been obtained, a good precaution consists in wearing an inguinal bandage for three or four months; for a principal advantage of the operation for congenital hydrocele is derived from the protection it affords against the production of hernia.

III. *On Diphtheritic Ophthalmia.* By MM. WARLOMONT and TESTELIN. (Annales d'Oculistique, vol. xxxvi. pp. 228–243.)

This article constitutes one of the additional chapters its authors have contributed to their translation of the last edition of Mackenzie's treatise 'On Diseases of the Eye.' A form of pseudo-membranous ophthalmia was, they say, indicated by Bovisson, of Montpellier, in 1847; and M. Chassaignac has alluded to the pseudo-membranes which occur in the ophthalmia of new-born infants; but the present affection has been particularly described by Gräfe, of Berlin, the disease indeed, thus far, seeming peculiar to Germany.

Symptoms.—In an eye in its normal state, but more frequently in one that has already suffered from inflammation, great irritation is suddenly set up, accompanied by much tumefaction of the conjunctiva, an inconsiderable amount of chemosis taking place. A network of large vessels ramifies over the conjunctiva, and the membrane itself, of a yellowish colour, is marbled over by a great number of minute red points. If an incision be made into the chemosis, fluid does not flow out, the submucous tissue being infiltrated with gelatiniform fibrin. The upper eyelid is remarkably tense, and so much pain does its eversion produce, that Gräfe resorts first to chloroform. When the conjunctiva is thus exposed, it presents a polished yellowish colour, which is due to a fibrinous exudation that penetrates into its substance, and leads to arrest in the circulation. The exudation can only be detached from the membrane with difficulty. It may be well seen by causing the patient to look downwards, and by everting the superior eyelid sufficiently to see the oculo-palpebral fold. The lower eyelid is also rigid, but little moveable, and very red. Besides the symptoms mentioned, there are two others—a great and continuous increase of temperature, and an abundant discharge of a dirty grey fluid, carrying with it yellowish flocculi. This condition, which constitutes the *first* stage of the affection, continues for a longer or shorter period; and the diphtheritic process may still be going on after the original swelling of the eyelid has diminished.

After awhile the rigidity of the eyelids disappears, and the conjunctiva assumes a spongy appearance, abundant fibrinous masses becoming detached from its surface. In parts it may retain its habitual colour, while in other places the exposure of the vessels gives rise to copious bleedings. The portions deprived of the mucous membrane swell more and more, and assume an appearance very like that seen in chronic blennorrhœa. There are also numerous nodosities formed upon portions of the conjunctiva, which, resistent at first, soften with the progress of the affection. The chemosis of the ocular conjunctiva now loses its hardness and yellow colour, and a dense vascular network is developed, so that the diagnosis of the affection at this period is very difficult.

The third stage is characterized by retraction of the eyelid, proportionate to

the amount and depth of the original fibrous infiltration. In some patients, day after day false membranes are removed three-quarters of a line in thickness, and having a hole in the centre corresponding to the circumference of the cornea. These are the pathognomonic signs of the affection; but to them may be added various degrees of opacity or ulceration of the cornea.

Nature and Causes.—As to the nature of the affection, it is derived from an inherent disposition of the mucous membrane to take on the diphtheritic action. It is a general disease, occurring more frequently in unhealthy than in healthy individuals, and internal affections frequently prevail during its progress. Thus, among 40 children, the subjects of it, M. Gräfe found death result in 3 from croup, and in other instances from pneumonia or hydrocephalus. It also frequently coincides with diphtheritic inflammation of the skin or apertures of the mucous membranes. Eight of these 40 children were the subjects of congenital syphilis. When one eye is affected the other often suffers, whatever precautions may be taken to prevent inoculation. Epidemic influences are its principal cause, for after months have elapsed without a case occurring, great numbers may be suddenly met with. New-born infants are not especially predisposed to it, although in the ophthalmia they suffer from; a fibrinous exudation, giving a certain amount of rigidity to the eyelid, may be observed. The affection is indubitably contagious. As already-existing inflammation, especially when traumatic, predisposes to it, operations must be abstained from when the affection prevails epidemically.

Diagnosis and Treatment.—The only affection it can well be confounded with is gonorrhœal ophthalmia, and the author exhibits the distinctive signs at some length. With respect to treatment, copious depletion, by means of leeches applied near the angle of the eye, but especially to the root of the nose, is recommended by M. Gräfe. Ice-cold affusions are also to be frequently applied, and the eye is to be kept scrupulously clean, for which purpose milk is one of the best appliances. In certain forms of the disease caustics may be required. M. Gräfe strongly recommends the energetic employment of mercury, this being the only internal medicine of any value. The regimen must be strict, and but little fluid should be taken. In several cases the second eye has been preserved from an attack by keeping it closed.

IV. *On Tracheotomy in Croup.* By M. André. (Bullétin de Thérapeutique, tome lii. p. 471.)

The medical officers of the Hôpital des Enfans have long advocated an early performance of the operation of tracheotomy in croup; and M. André, one of the *internes* of that institution, has just published an account of the operations performed during 1856. The following table exhibits the results according to age:—

Age.	Total.	Deaths.		Recoveries.	
		Boys.	Girls.	Boys.	Girls.
15 months to 2 years	6	2	4	—	—
2 to 3 years	9	4	3	2	—
3 to 4 „	13	5	4	4	—
4 to 5 „	11	6	3	1	1
5 to 6 „	6	3	1	1	1
6 to 6½ „	3	1	1	—	1
7 years	2	—	1	—	1
8 „	2	—	1	1	—
9 „	1	—	—	1	—
9½ „	1	—	—	—	1
	54	21	18	10	

Thus it will be seen that a considerable proportion of the cases were successful, and that this has been so in proportion as the children have been advanced in age. In all the children of less than two years of age, the operation proved fatal; and the others who succumbed, with two exceptions, scarcely exceeded that age. In the two older children (seven and eight years of age) who died, there were other causes of death independently of the operation. The explanation of this circumstance M. André supposes to exist in the fact that children of four years of age, who recover more frequently than younger children, offer greater resistance to both the accidents of the operation itself, such as hæmorrhage and traumatic fever, to the diphtheritis, and the complicating affections, such as capillary bronchitis and pneumonia. They are also more docile, and allow more readily of the repeated examinations of the wound and canula that are necessary; while suitable diet, so essential, and so difficult of management in very young children that have been operated upon, is more easily regulated. It is probably also due to the greater power of resistance possessed by boys, that the proportion of their recoveries exceeds that of the girls. Another circumstance to be mentioned is the deplorable facility with which children who have not already had the measles or scarlatina contract these affections upon admission into the hospital; and although, usually, eruptive fevers are uncommon prior to the fifth year, scarlatina attacked no less than ten of these little patients, of whom a third part died. M. André agrees in the justice of the opinion long held by the officers of the hospital, that the ulterior success of tracheotomy is much interfered with by the earlier employment of debilitating remedies, such as venæsection, leeches, blisters, &c.

V. *A Case of Strangulated Hernia Obturatoria.* By Dr. Lorinser. (Wien Wochenschrift, 1857. No. 3.)

As far as the author is aware, there is but one case on record (by Mr. Obré, in the "Medico-Chirurgical Transactions," vol. xxxiv.) in which this form of hernia has been recognised during life and relieved by operation; and even in that instance, the nature of the hernia was not suspected prior to the commencement of the operation. He now relates a case which occurred to himself, the nature of which was detected, and an operation performed with success.

On July 21st, 1856, a feeble, spare woman, aged sixty-five, while reaching a heavy object from on high, felt as if something burst in the groin. She was seized with pain in the abdomen and vomiting, and was brought to the hospital, and as there was no appearance of a hernia, she was at first supposed to be suffering from simple peritonitis. To the other symptoms were, however, added obstinate constipation, and after a while, fæcal vomiting. The author first saw her on August 1st,—i. e., eleven days after the accident—when she exhibited general symptoms of the most unfavourable description. On examination, the inguinal and femoral canals were found quite free, but the triangular space formed by the adductor longus, Poupart's ligament, and the femoral vessels, was observed on the left side to be level with the surface, instead of depressed as on the right side. When the fingers were passed upwards towards the foramen ovale, a soft swelling, about the size of an egg, and sensible to pressure, was perceived behind the pectineus, stretching from the foramen ovale to the outer border of the adductor. It was placed posteriorly, and somewhat internally to the pectineus, and was yielding rather than tense, the colour and temperature of the skin covering it being normal. Upon percussion, the tumour imparted a deep, full, tympanitic tone. From the vagina, a somewhat tense, very sensitive tumour could be felt at the posterior edge of the foramen ovale. All movements of the thigh caused pain. The diagnosis

was much facilitated by the spareness of the woman, and by the tympanitic tone elicited by percussion over the whole circumference of the tumour.

From the duration of the strangulation, and from the full, deep tympanitic sound, it was concluded that the intestine had become perforated and gas effused into the sac. An operation was, however, resorted to, and the pectineus being brought into view, it was slit up, somewhat obliquely, upon a grooved director, as far as the border of the adductor. Immediately behind it was found cellular tissue filled with exudation, and then the discoloured and softened sac. On opening this, a stinking fluid, partly watery, partly purulent, and containing particles of fæcal matters, flowed out. The finger was now passed into a cavity which was bounded upwards by the obturator ligament, and in a cleft at the upper part of this ligament, and in part adhering to it, lay a relaxed and collapsed portion of intestine, about the size of a walnut. Behind the intestine, at the lower angle of the cleft in the ligament, the pulsations of the obturator artery were supposed to be felt. On account of the great depth of the parts, no ocular examination of the intestine could be made. As the intestine was ruptured, and sufficient egress of the contents was secured, further division of the fibrous cleft was abstained from, in order not to endanger the separation of the recent adhesions, and consequent fæcal effusion into the abdomen. The chief care was employed to secure a free discharge of the fæcal matters, preventing them lodging in the surrounding cellular tissue. To this end the cavity of the sac was well syringed out, linen rags being then applied, and the whole covered with cold applications. A clyster of tepid water was ordered every two hours, and the diet was low.

As soon as a certain amount of fæcal matters had been discharged through the wound, all symptoms of strangulation ceased. For the first few days, the discharges of fæces were pretty frequent, rendering the repeated cleansing out of the wound requisite. The clysters were soon employed but twice a day, a small quantity of fæces being discharged per anum. As these discharges continued, and contained matters of which the patient had partaken since the operation, there seemed every probability that only one side of the intestinal noose had been strangulated, the uninjured portion keeping up the communication between the upper and lower portions of the gut. The wound gradually cleansed and diminished in size, while the woman's strength and appetite increased until the end of August, when she became the subject of bronchitis. This delayed her progress, but by November the fæcal fistula, which had long been inconsiderable, had quite closed, and she only remained longer in the hospital on account of the chest affection.

VI. *On Bleeding from the Ear as a Consequence of Injury done to the Chin.* By M. MORVAN. (Archives Générales, cinquième série, tome viii. pp. 653-664.)

Bleeding from the ear as a consequence of *contre-coup* has been accepted by surgeons as an almost certain indication of fracture of the base of the cranium. M. Morvan has, however, met with two cases in which injury to the chin gave rise to this phenomenon. The subject of the first of these was a robust lad, five years of age, who had, five or six hours before the author's arrival, fallen on his face on the pavement from a height of several feet. Immediately after the fall, a large flow of blood took place from the right ear, this being continued, when M. Morvan saw him, only in occasional drops, in which condition it lasted for three days longer. No fracture or dislocation of the jaw could be detected, and the membrana tympani was not ruptured. The child suffered much from pain in front of the right ear, from attempts at deglutition, and from any movement of the jaw. In the second case, a very strong man, aged forty-seven, received a kick from a horse on the chin, which almost deprived,

him of consciousness, and gave rise to an abundant jet of blood from the right ear. No fracture or dislocation could be found, but deglutition was excessively difficult. Prompt depletion dissipated the cerebral symptoms, and all went on well, a considerable amount of deafness remaining in the right ear. The membrana tympani was uninjured.

On searching, the author has been able to find only three analogous cases, and these only meagrely detailed, making thus, with his own, five cases. In three of these, the blow on the chin resulted from a fall, and in two was produced by a kick from a horse. In three, the bleeding took place from one ear, and in two from both ears. In the author's cases, the force acted obliquely, and the bleeding occurred on the opposite side to that of the point of contact. When bleeding has occurred from both ears, the blow has been central. In one only of the five cases did fracture of the jaw occur. In order to produce bleeding by this form of *contre-coup*, it is probably necessary that the shock should be entirely transmitted to the articulation of the jaw, while when fracture takes place, its force is usually exhausted in the production of the lesion of the bone. In the three cases in which the point has been noted, the difficulty of deglutition and mastication has been excessive at first, and has continued for a long period; and M. Morvan suggests that the lesion which gives rise to this symptom, as well as to the bleeding from the ear, is a fracture across the glenoid cavity, which explains the occurrence of the abundant hæmorrhage, the membrana tympani remaining entire. Some experiments he has made in the dead body, by inflicting blows upon the chin, have failed to produce this form of fracture, but have induced fracture of the base. Thus no doubt can exist that this description of *contre-coup* may also produce fracture of the base, with bleeding from the ear, and rupture of the membrana tympani; but when we meet with such bleeding as a consequence of violence done to the chin, and without rupture of the membrane, the hæmorrhage may be regarded as a far less dangerous symptom.

VII. *On Secondary Syphilitic Affections of the Lachrymal Passages.* By M. Lagneau, Jun. (Archives Générales, cinquième série, tome ix. pp. 536–555.)

M. Lagneau, after taking a review of the scattered observations which have been made upon this subject by various authors, and narrating the particulars of four cases that have come under his own notice, arrives at the following conclusions:

1. The syphilitic nature of certain affections of the lachrymal passages seems sufficiently proved; 2 There is usually more or less complete obliteration of one of the lachrymal points, which is generally caused by an osseous lesion (periostitis, exostosis, caries, or necrosis), having its seat in the os unguis and the ascending apophysis of the maxillary bone—sometimes in the angular apophysis of the frontal bone. Sometimes the closure seems to depend upon swelling of the inflamed mucous membrane, arising from chronic blephoritis, and at others upon a lesion analogous to and accompanying naso-palatine syphilitic affections. 3. The symptoms which enable us to distinguish syphilitic from other affections of these parts, are the existence of a hard, resisting tumour,—the chancrous appearance of the cutaneous surface of the fistula lachrymalis, when this is present,—the co-existence of syphilitic affections of the mucous membrane, or bones of the palate and nasal fossæ,—the presence of syphilitic eruptions of the face, and the co-existance of supra-orbital cephalalgia and exostoses,—together with the history of the patient, or the discovery, on inspection, of the marks of syphilis on other parts of the body; 4. The progress of the affection is usually indolent, although sometimes there is a certain amount of erysipelatous inflammation; 5. The prognosis of syphilitic

disease of the lachrymal passages and of adjoining parts (ancholops, ægilops) is less serious than when the same affections are not induced by a specific cause, for, when it is employed in time, they are usually curable by appropriate treatment; 6. When the obliteration is due to only a lesion of the soft, in place of the osseous parts, we may sometimes, as a palliative treatment, re-establish the channel for the tears by means of catheterism; 7. Most of the cases recorded have been successfully treated by mercury; but the author thinks, with M. Tavignot, that the iodide of potassium may be usefully employed when the bony parts are affected.

QUARTERLY REPORT ON MIDWIFERY.

By Robert Barnes, M.D. (Lond.)
LETTSOMIAN LECTURER ON MIDWIFERY, ETC. ETC.

I. Physiology and Pathology of the Unimpregnated State.

1. *On Amyloid Degeneration of the Female Sexual System.* By Virchow. (Monatsschr. f. Geburtsk. April, 1857.)
2. *Case of Artificial Enucleation of a Large Fibroid Tumour of the Uterus.* By T. F. Grimsdale, Esq. (Liverpool Med.-Chir. Journal. January, 1857.)
3. *Clinical Researches on Peri-Uterine Phlegmons.* By G. Bernutz and E. Gonfil. (Archives Gén. de Méd. March, 1857.)
4. *Case of Peri-Uterine Hæmatocele Cured.* By Dr. Marc Picifio. (Gaz. Méd. d'Orient. May, 1857.)
5. *On Blistering the Cervix Uteri.* By Dr. Johns. (Dublin Quart. Journ. May, 1857.)
6. *On the Treatment of Ovarian Dropsy by Iodine Injections.* The discussions in the French Academy of Medicine. (Union Médicale; Gazette des Hôpitaux. 1856 and 1857.—M. Dolbeau: Gazette Hebdomadair. Oct., 1856.—M. Philipart: Gazette des Hôp. January, 1857.—M. Pignaut: Moniteur des Hôp. January, 1857.)

1. Virchow has related to the Berlin Obstetrical Society a case exhibiting a form of disease of the female generative organs not hitherto described, which he calls "Amyloid Degeneration." It was that of a woman who had sunk under amyloid degeneration of different organs, and who exhibited the entire sexual system affected by this peculiar process, which of all diseases is that which has the widest extension throughout the organism. The degeneration extended over the ovaries, tubes, and uterus, the last being in consequence enlarged, transparent, clear, and remarkably anæmic. The deposition of the amyloid mass had here particularly followed the organic muscular fibres, so that scarcely one of these did not present the characteristic iodic reaction. The disease had in this woman, as commonly happens, run its course concurrently with the symptoms of Bright's disease.

2. Mr. Grimsdale's case of artificial enucleation of a large fibroid tumour of the uterus is a valuable illustration of the pathology and therapeutics of this affection. The tumour occupied the posterior wall of the uterus and cervix: an incision was made in the posterior cervix, forming a sort of artificial os for the tumour; through this the tumour was gradually projected by the contraction of the womb, ergot of rye being repeatedly given, and on the fifteenth day it was wholly severed by breaking down adhesions with the finger and the scissors. A good deal of irritative fever accompanied the extending process. No hæmorrhage attended the final separation. Mr. Grimsdale contends that the operation for enucleation is occasionally not only justifiable, but desirable.

3. Drs. Bernutz and Gonfil have contributed a valuable clinical contribution to the history of peri-uterine inflammation, an affection which, under different names, has lately attracted particular attention. They first relate in detail two cases of peri-uterine inflammation, in which swellings, taken to be symptomatic of pelvic cellulites, had been recognised during life, but which, terminating fatally through intercurrent diseases, were found on dissection to present evidence of peritoneal inflammation only.

Case I.—Absence of previous uterine affection, blennorrhagia occupying the urethra, vagina, and uterus; the twelfth day after the commencement of this blennorrhagia, general illness and acute pains in the inferior part of the belly. On the twentieth day, when admitted into the l'Ourcine Hospital, very acute pain was manifest in the hypogastric region, especially on the left, and the touch revealed a tumefaction surrounding three-fourths of the uterine neck. An acute pleurisy supervened, which destroyed the patient. Peritoneal adhesions were found uniting on the median line the bladder and the anteflexed uterus, and fastening the uterus to the ligmoid flexure and rectum; on the right, adhesions united the sigmoid flexure, which was much "elbowed" to the broad ligament; on the left, adhesions united the parietal peritoneum to the broad ligament, the sigmoid flexure, and rectum. Between these organs—that is, placed behind the broad ligament, in front of the ligmoid flexure, was an intra-peritoneal collection of pus in contact with the left ovary, the proper tissue of which was healthy, as was that of the opposite side. The cellular tissue which surrounded the uterus and broad ligaments was healthy.

Drs. Bernutz and Gonfil are of opinion that the blennorrhagic inflammation extended along the Fallopian tubes, leading to an ovaritis, in a manner analogous to the extension of blennorrhagic inflammation along the epididymis to the testicle in the male. They remark that the dissection which revealed the healthy state of the cellular tissue of the uterus and appendages compelled them to renounce the conclusion they had arrived at during life, that the cellular tissue was the seat of the peri-uterine induration. This was in reality formed by the peritoneal adhesions binding the pelvic organs together in an irregular manner.

Case II.—Regular menstruation; pregnancy; labour and puerperal stage normal; vaginitis cured without having caused any morbid disorder of the uterus; syphilis. During the treatment of this disease, the catamenia, heretofore regular, were suppressed after two days. Shortly afterwards, development of a retro-uterine phlegmon; malignant small-pox, rapidly fatal. The autopsy revealed uterine deviation; peritoneal adhesions between the posterior surface of the uterus and rectum; the peri-uterine cellular tissue healthy; inflammation of the Fallopian tubes. Drs. Bernutz and Gonfil make a similar commentary upon this case They remark that in them and in another (cited in a previous Midwifery Report), peritoneal adhesions binding together loops of intestine, may so closely simulate a tumour containing a liquid as to deceive even skilful exploration.

The next case exhibits a peri-uterine phlegmon, originating in a more usual way—namely, in labour.

Case III.—Hysteria; dysmenorrhœa; cessation of hysterical complications when the patient became pregnant; laborious delivery, followed in a few days by metro-peritonitis, which persisted in a latent form for five months. At this period the catamenia returned, and at the same time the acute symptoms. She was admitted into the wards of M. Valleix, when the existence of a purulent collection, which soon emptied itself by the rectum, was recognised. Scarcely discharged from the hospital, the symptoms returned. Admitted under M. Nélaton, who recognised peri-uterine phlegmon. Relieved, she returned to the care of M. Valleix, who after some time applied his uterine pessary, in order

to cure the pains experienced by the patient, and which he attributed to the existing retroversion. The instrument was abandoned, on account of the pain and renewal of hysterical attacks it produced. Concurrently with these hysterical attacks, pelvic pains, and existence of peri-uterine tumours, for which the patient successively entered the wards of MM. Gendrin, Monat, Briquet. The symptoms abated concurrently with the spontaneous cessation of menstruation and the development of pulmonary phthisis. For this last disease she came under the care of M. Bernutz, and died five years after the labour to which she ascribed all her sufferings. The autopsy revealed peritoneal adhesions binding together all the pelvic organs, and these to the pelvic peritoneum. The cellular tissue of uterus and broad ligaments was healthy. The authors infer that the terms "pelvic cellulitis," "peri-uterine phlegmon," imply an erroneous pathology, and ought to be replaced by peri-uterine peritonitis. It is a return to the old pathology. They cite Andral's authority in support of their interpretation of the last case.

4. The diversity of opinion yet entertained as to the pathology, diagnosis, and treatment of the various forms of pelvic sanguineous effusions, renders it desirable to collect cases throwing light upon this affection. That of Dr. Picifico is interesting. A Turkish woman, aged fifteen, menstruated from thirteen normally; had been married nine months. Three months after marriage, she began to experience bearing-down pains, and sexual intercourse became too painful to be continued. When examined, a large ovoid tumour, with limits well marked, resisting, elastic, painful on pressure, was felt extending obliquely from below upwards from the left iliac fossa to the level of the umbilicus; excessive pain in groins, especially in the left, and in the loins. Examination by vagina reveals a large tumour bulging into the vagina and filling it; the neck of the uterus—very high—was thrown forwards, and to the right. The temperature of the vagina was increased, its sensibility also; fluctuation was very clear. The tumour also pressed upon the rectum; no febrile movement or shivering. An exploratory puncture was made at the most fluctuating point of the vaginal tumour. A dark red liquid escaped in small quantity. A discharge of similar fluid continued for some days. Fifteen days after puncture, the tumour had diminished considerably, but the patient was much exhausted. Frictions with iodine ointment, and steel pills were prescribed. Three weeks after puncture, a severe hæmorrhage suddenly took place: the tumour had opened in the vagina, and discharged a considerable quantity of blood. This ceased on the following day. Great febrile irritation, with shiverings and depression, followed, and fluctuation increased. A second exploratory puncture was made by the vagina, and then ichorous and very fœtid pus escaped. The opening was enlarged by a bistoury, and the sac washed out by injections. Instant relief followed. Under quinine and good diet, the patient recovered favourably, the tumour completely disappearing.

Dr. Picifico remarks that there appeared two distinct stages in this case: the first, *hæmorrhagic*, the second, *phlegmasic*. Was the hæmorrhagic effusion caused by the ovarian irritation produced by early marriage?

5. Dr. Johns recommends the practice of blistering the cervix uteri in those cases especially in which, after active inflammation has been subdued, neuralgic pains persist. The agent he employs is the following: a strong solution of cantharides in chloroform, in which some gutta-percha is afterwards dissolved. This is applied by a camel-hair pencil. It is said to cause very little pain, either during or after application. Small vesications appear at the time, and a watery discharge sets in within half an hour. This discharge starches the linen, and is in other respects similar to that from blisters exter-

nally formed; it lasts commonly for three days, when to it succeeds one of a slightly purulent nature, but not productive of pain. At this stage the epithelium is thickened and raised, and comes off in patches, like bits of chewed paper. Dr. Johns has never seen strangury follow. He relates several cases illustrating the beneficial effects of the remedy.

6. The question how far and in what cases iodine injections can be trusted to as a cure of ovarian cysts, is one of great interest in itself, and it has lately assumed a greater relative importance since the operation of ovariotomy has been generally condemned. The question is mainly to be solved by experiment. The collection of authentic cases in which this method has been tried is, therefore, a task of immediate practical utility. In the recent discussion upon this subject in the French Academy of Medicine, M. Caseaux brought forward from Boinet, Monod, Nélaton, Demarquay, Giraldès, Maisonneuve, Simpson, and others, 117 cases of ovarian cysts in which iodine injection had been used. In some of these it was previously determined to close the wound immediately after the operation; in others, to incite suppuration by leaving a canula in communication with the sac. It appeared that the iodine injection had acted most favourably in all; for in all the 117 cases, not one exhibited a serious mishap. There were 62 cases of unilocular serous cysts, of which 48 were cured; 11 were operated upon without result; in only 4 did death follow. In the 11 cases some improvement was observed.

The experiments with the retained canula were, for the most part, unfortunate.

To this summary we will add some cases recently recorded:

1. M. Dolbeau: A woman, aged thirty-nine, had borne two children. Symptoms of ovarian disease had commenced seven years back. Two years back the tumour had been apparently spontaneously healed by the bursting and escape of a quantity of fluid through the vagina, but in six months the tumour had resumed its former size. In December, 1855, the sac was punctured, and four litres of albuminous fluid drawn off. The canula was left in the sac. Purulent discharge came after a time. On the eighth day the purulent matter was fœted, and an iodine injection was thrown in; but the patient got worse, and sank under profuse diarrhœa on the 19th. Autopsy showed the cyst much contracted; the walls were fibrous, of various thickness, and in three points occupied by fibrous tumours. The inner surface was lined by a yellowish, strong, resisting membrane, pieces of which were found in the fluid, and plainly consisted of a combination of the iodine with the organic substance. It contained small vessels, and was easily separated from the wall of the sac.

2. M. Philipart's case. A woman, aged twenty-three, had menstruated regularly from the age of sixteen. Increase of size of abdomen first observed in 1852. On September 25th the first puncture was made, and twenty-five litres of albuminous water withdrawn. This operation was repeated thirty-five times, down to October 18th, 1855. The condition of the patient had become worse. Iodine injection was then determined upon. Thirty grammes of tincture, 4 grammes of iodide of potassium, and 250 grammes of water were injected; no pain. Irritation at first; but in a few days improvement. On October 26th, the injection was repeated; considerable reaction ensued. On January 3rd, 1856, the third puncture; eight days after this her condition was quite satisfactory. The collection, however, returned, and down to March 6th, three more punctures were made, and the canula left in the wound. The patient is said to have been destroyed by an unskilful washing out of the cyst by a nurse, which caused a fatal peritonitis.

3. M. Pignaut's case. A woman, aged fifty, had recognised a simple cyst for fourteen years, which had latterly become so large as to be unbearable. After

puncture, iodine injection; no reaction followed. Cure was complete in fourteen days.

Several other cases have been reported in the British journals, which want of space forbids us from citing. Several cases are known to be under observation. It is hoped that within a reasonable time a sufficient body of experience to determine the application and value of this method will be amassed.

II. Pathology of the Fœtus.

Case of Double Fœtus. By Professor Meigs. (American Journal of Medical Science, January, 1857.)

Dr. Meigs's case of monstrosity is remarkable. It is an example of more or less perfect fusion of two embryos. The two heads present the least perfect fusion. The genital organs are female. The right eye of the right and the left eye of the left fœtus are perfect; while the right eye of the left, and the left eye of the right fœtus are fused together into one single eyeball, covered by a compound palpebra with three canthi, the fused inner canthus being in the middle of the lower eyelid. All traces of the outer canthi of this compound eye are lost. In the fusion of the heads, the left and right ears of the right and left fœtuses are lost, with the exception of a small tubercle seen in the middle of the faces. The left fœtus has a double hare-lip, and the right one a common hare-lip. The calvaria are deficient in both children, so that they are anencephalous. There was also failure of development of the spinous processes and bridges of the cervical and dorsal vertebræ, giving rise to spina bifida of both the dorsal and cervical ranges, while the lower lumbar and sacral vertebræ are perfectly well developed. This circumstance, Dr. Meigs observes, is interesting, showing as it does, that the simplicity apparent in the two well-formed arms and legs, and the single trunk, is nevertheless a real duality of individuals. The dark dermoid excrescence that covers the top of the head is too imperfect to contain any hair-follicles. There was but one navel and umbilical cord. Dr. Meigs however concludes, from physiological reasoning, that the liver was double. The specimen was not dissected, in order not to diminish its value as a museum object.

III. Pregnancy and Labour.

1. *Account of a Case in which Impalement of the Uterus occurred in the Production of Criminal Abortion.* By F. Broughton, Esq. (Transactions of the Medical and Physiological Society of Bombay, 1855, 1856.)
2. *Case of Ruptured Uterus.* By M. Reynolds, M.D. (Charleston Medical Journal, January, 1857.)
3. *Rupture of the Uterus. Gastrotomy successfully performed.* By John H. Bayne, M.D. (The American Journal of Med. Science, Jan., 1857.)
4. *Report of Seven Cases of Transfusion of Blood, with a Description of the Instrument invented by the Author.* By Alfred Higginson, Esq. (Liverpool Med. Chir. Journ., Jan., 1857.)

1. Nursingua was fifty years old. Her husband having died two years, she formed an intimacy with a goldsmith, and pregnancy was the unexpected and undesired result. To obviate discovery and evade the punishment inflicted in this country upon both parties when convicted of adultery, she was as usual tempted to submit to measures for the induction of abortion. A five months' fœtus was expelled. Slight hæmorrhage but considerable pain followed. The pain increased, and she was sent into hospital. She died in a few hours.—*Autopsy:* The abdomen was immensely distended with serum. Bands of coagulable lymph passed in every direction, of recent formation. The peritoneum fiery-

red, the whole mass glued together. Upon lifting up the bowels some difficulty was experienced in exposing the uterus, owing to the presence of a rod, which passed through the fundus and projected three inches into the bowels, which were lacerated, and hanging upon its extremity. The other and broken end occasioned the abrasion of the internal membrane. The uterus was firm, and tolerably contracted, and would appear to have been more passive under such fearful injury than the intestines. It is remarkable that the patient was fifty years of age, and that she survived this injury ten days.

2. Dr. Reynolds' case of ruptured uterus is referred to because it illustrates the conservative behaviour of the uterus in certain cases of this injury. A negress, in labour with twins, suffered rupture of the uterus during the expulsion of the first child. The second escaped into the abdomen. She died shortly afterwards. On autopsy, the fœtus and appendages were discovered in the abdomen. The uterus was so firmly contracted as to efface all visible mark of laceration until it was distended by passing the hand into the cavity. The seat of the laceration was the cervix; it ran somewhat obliquely, and measured in the contracted uterus three inches. A little coagulated blood was found in the cavity, and very little effusion of blood into the peritoneal cavity. There had been no hæmorrhage during labour. There was slight inflammation of peritoneum. The viscera were all in a state of integrity. [It may be assumed that this poor woman died of shock, since the strong contraction of the womb prevented all hæmorrhage. The Reporter has witnessed a case of recovery after rupture of the womb, in which powerful contraction of the womb was the conservative agent. The rupture occurred during the delivery of triplets. The children and three separate placentæ were expelled *per vaginam*. A large loop of intestine was *felt and seen* protruding between the thighs. This was spontaneously retracted, and the woman completely recovered. This tendency of the uterus to contract being an essential element in the process of recovery, should not be frustrated by attempts to drag the child back through the rent, in order to deliver *per vias naturales*. If the child has been cast into the abdomen, gastrotomy seems to be indicated by nature.—R. B.]

3. Dr. Bayne's case of rupture of the uterus occurred in a woman aged twenty-five, of robust constitution, in her fourth labour. When seen she complained of having experienced some hours previously an excruciating pain in the epigastrium, accompanied with a peculiar tearing sensation. There was then an entire cessation of pain and of all expulsive uterine efforts. Pulse 130. Difficulty of respiration, and prostration. Coma, and tendency to collapse. The head of the fœtus felt at first presenting, seemed to be rapidly receding; and in a very short time the entire contents of the uterus had escaped into the abdomen. Child then felt very distinctly through the parietes of the abdomen. An extensive laceration had taken place in the anterior portion of the fundus. Gastrotomy was immediately performed, without anæsthetic agents; as soon as the abdominal cavity was opened, there was a sudden gush and escape of at least one quart of sero-sanguineous fluid. No hæmorrhage. A very large fœtus was removed. Womb at the rupture thin, and the laceration jagged and irregular. Peritonitis set in on third day. A dark grumous, offensive, purulent discharge continued *per vaginam* for several weeks. She recovered. Dr. Bayne observes that the antero-posterior diameter was less than the standard, and the capacity of the pelvis less than usual. Her labours had always been protracted. He does not refer to the condition of the womb as regards contraction.

4. The cases of transfusion reported by Mr. Higginson are of extreme interest. We cannot extract the description of the author's instrument. It is

ingeniously contrived to keep the blood used for transfusing warm, and to prevent the injection of air into the vein.

The following is a summary of the cases:

Case I.—*Extreme prostration from protracted suckling of twins.*—The exhaustion was extreme; the patient fainted when raised from her pillow; it was considered she would die during the night. Twelve ounces were injected from a healthy female servant; a state of quietude succeeded; pulse improved; she seemed sleeping; but in a few minutes a rather severe rigor came on. This did not last; reaction occurred; the patient sang a hymn in a loud voice. She steadily recovered.

Case II.—*Hæmorrhage after birth of child, on expulsion of placenta.*—Complete prostration from sudden loss. The lady's sister supplied the blood, and between ten and twelve ounces were easily injected. The benefit was immediate and striking, and no bad symptoms retarded her recovery.

Case III.—*Hæmorrhage from Placenta Prævia. Fœtus retained.*—Sudden and exhausting hæmorrhage. The placenta had been removed; the child's head occupied the os uteri, and hæmorrhage was over. The skin was of a livid hue, as in the asphyxiated stage of cholera. A female servant gave the blood, and six or eight ounces were injected, when a sudden jactitation jerked the pipe from the arm; coagulation impeded the operation. She died within half an hour, undelivered.

Case IV.—*Hæmorrhage from adherent placenta. Uterus empty; hæmorrhage ceased.*—Twelve ounces were injected. The patient lived seven days, but gradually sank. Uterus found internally purulent and offensive. No disease of the veins, either in the uterine region, or in the arm where the puncture had been made.

Case V.—*Partial Placenta Prævia. Hæmorrhage before delivery.*—Partial separation; great hæmorrhage. Woman appeared sinking, neither placenta nor fœtus expelled; hæmorrhage had however ceased. The blood injected was "dark and sluggish," and produced scarcely any effect, not more than five or six ounces having entered. Warm water with a little common salt was then injected to twelve ounces, slightly improving the circulation. Delivery was then speedily effected, but life was extinct before this was fully accomplished. [The Reporter would observe, that although the delivery was here, according to received rule, forced, yet this operation was precisely calculated to extinguish the patient. Why was it held necessary? The hæmorrhage had ceased. But it might return? This fear is not altogether justified by the true physiology of placenta prævia, nor by clinical experience. The natural hæmostatic stage had been reached; the labour had truly become a natural labour.]

Case VI.—*Mania: refusal to take food; exhaustion; approaching collapse.*—Pulse had disappeared from the radial arteries. A good supply of rather dark blood was obtained from a female. Pulsation returned at intervals, the breathing improved, and the expression of the countenance became much better. Twenty ounces or more were injected. The following day she appeared better, but sinking came on, and she died in forty hours. The heart contained dark fluid blood.

Case VII.—*Placenta prævia (forced); delivery, and subsequent draining; transfusion, and rally of the patient; return of flooding; death.*

MEDICAL INTELLIGENCE.

Vaccine Stations at Hospitals.

THE 'Annual Report of the National Vaccine Board,' issued in the month of March of the present year, concludes with a suggestion which we think cannot too soon be adopted, and as it would be difficult to discover any reasonable objection, we trust that by giving it further publicity we may secure its speedy realization. The Board are of opinion that it would be "very advisable that all the metropolitan hospitals should institute the plan of having one of their house-surgeons specially appointed to the duty of vaccination." It is obvious that, by the introduction of this feature, students would have an opportunity of becoming properly acquainted with the course of the vaccine disease, no less than with the proper mode of performing the operation. At present the young practitioner acquires this knowledge in a fortuitous way, and at the commencement of his practice feels less confidence in this matter than in more serious proceedings. And yet it is important that every practitioner should be well informed in regard to the theory and practice of vaccination. Moreover, if this subject is properly carried out at hospitals, we shall acquire a further field of study, which will not fail to yield fruit. Thus the question of the influence of vaccination in the production of other diseases, which has a strong hold upon the public mind, has never been properly investigated, and, with others of a similar bearing, would be more readily solved if subjected to a general and careful scrutiny.

We may take this opportunity of reassuring the profession of the real value of vaccination. The Report gives us statistics which amply confirm the protective power of the vaccine lymph, while, *per contra*, unmodified small-pox is shown still to offer all its former terrors. We quote the following remarks from the document, in evidence:—"Mr. Marson, surgeon to the Small-Pox Hospital, states to the Vaccine Board, that in five years, from 1852 to 1856, 2253 patients have been admitted into the hospital with small-pox after vaccination. Of these, 355 had each four or more vaccine cicatrices. Three of these patients have died, one from small-pox, and two from superadded disease, wholly independent of small-pox; so that it may be fairly said, deducting two cases, that of 353 patients having four or more cicatrices, only one died. This number added to the cases already published, makes 620 cases followed by three deaths, or rather less than half per cent.

"For sixteen years, in the published accounts, the unvaccinated cases die at the rate of 35 per cent.; and the patients badly vaccinated, having only one indifferent cicatrix, or none at all, but believing themselves vaccinated, died at the rate of 15 per cent. This statement shows, 1. The great loss of life from natural small-pox; 2. The great protective power of vaccination.

"The Board therefore feel fully justified in unhesitatingly reiterating, that vaccination properly performed is all but a complete protection."

Middle-Class Education.

Fact is indeed stranger than fiction. What many of us have yearned for, but what none could have expected to see realized, is come to pass: Oxford and Cambridge have spontaneously, and with all the gracefulness of ancient lineage, offered to become the patrons and promoters of the education of the middle classes of this great country. The silent working of the spirit of intellectual development, the germination of the seeds of mental growth, scattered with no sparing hand by the best of their generation through the land, have been observed and acknowledged by those whom we all would wish to regard as the watchers over the mind of the nation, no less than the tutors of the few.

Oxford has taken the lead in an undertaking which the promoters themselves may scarcely compass in its promise of rich and never-failing fruit, which will develope the intellectual energies of the people of England, and fertilize the fields of mental culture now unproductive from mere want of seed, while it will redound to the honour of the Universities, and secure to them a power which will find no rival in ancient or modern story.

We should be loth to withhold our sympathies from any great movement affecting the highest weal of our compatriots; but the proposal to which we advert has a special bearing upon the medical profession, to whose attention we therefore warmly commend it. The Rev. F. Temple—to whom be all honour as the immediate originator of the scheme in question!—proposes that Oxford and Cambridge should undertake the task of guiding and testing the instruction given in the schools of the middle classes. Their education, he observes, in a letter addressed to the Master of Pembroke College, Oxford, suffers at present from the want of any definite aim to guide the work of the schoolmasters, and from the want of any trustworthy test to distinguish between good and bad. Mr. Temple dwells upon the unsatisfactory results generally obtained in the private schools of the middle classes, where the masters rarely sufficiently understand their duties, or know the precise object they are to aim at: and where they thoroughly understand their duties, they have no means of convincing the parents of their pupils that they are doing so.

Mr. Temple proposes no complicated scheme in order to place middle-class education on a proper basis. He asks that "the University should confer some such title as Associate in Arts on every person who passed an examination before examiners appointed either by the hebdomadal Council, or by a delegacy, as might be thought best." This examination should pretty nearly follow the precedent set by the present final schools. "It should be held annually in Oxford. But if the gentry or local authorities of any place asked for an examination to be held in their neighbourhood, and would undertake to bear the expense of the necessary arrangements, an examiner should be sent down to them."

That the country will be glad to avail itself of a test such as the one proposed, can scarcely be doubted. There may be sluggards and dullards who would rather lag behind, or avoid entering into a new and an unknown course; but the *vis à tergo* will be too powerful for them, and the current once having set in, will sweep along with it all recusants.

The desire of the public for an independent standard has been manifested on various occasions. One of the best known schemes of examination of an analogous character is that commenced already by the Society of Arts; and the best evidence of the value in which it is held, is afforded by the number of persons who subject themselves to the ordeal, and the interest taken by their friends in the success or failure of the denizens of distant towns and counties, as recorded in the daily papers. But important and demonstrative as these individual instances of spontaneous action may be, they will fail of the universal influence that must be acquired, unless a general organization is secured. It is this that is held out by the proposed scheme of Mr. Temple.

The importance of the certificate to be obtained will be a sufficient security that the examinees will not be wanting. The security that the examiners will do their duty, will lie in their independent position,—independent as far as petty and local or nepotic influences are concerned, dependent only upon the controlling influence of enlightened public opinion.

The medical profession cannot, we are assured, but hail the prospects of a high standard of testing preliminary education—the education that must precede professional studies, if those studies are to bring fruit commensurate with their importance. Our medical corporations have striven nobly to secure this preliminary education in all their candidates, but it is manifestly not the

proper sphere of a licensing body to do more than to ascertain the fact that the candidates have gone through a suitable curriculum. It will therefore necessarily be their interest to promote such a scheme as the one proposed, by requiring all their candidates not possessed of a University degree, to pass the examination before the Oxford or Cambridge Board. We would suggest that they at once put themselves in communication with the Board, as soon as constituted, so as to arrange about the character of the examination which they would wish to regard as a minimum qualification.

With these few remarks, and with a special request to our readers to study a pamphlet by Mr. Acland,* on 'Middle-Class Education,' in which these questions are amply discussed, though without reference to individual classes, we introduce the subject to our readers, fervently hoping that they may, as far as in them lies, give their full aid in realizing a scheme fraught with immeasurable benefit to our children and children's children.

Since the preceding observations on Middle-Class Education have been in type, we have received the following Report, which we have much pleasure in introducing to our readers:

"*Report of the Committee on Middle-Class Examinations.*—(Dr. Williams, Vice-Chancellor; Dr. Cotton, Provost of Worcester; Dr. Jeune, Master of Pembroke; Dr. Scott, Master of Balliol; Dr. Cradock, Principal of Brasenose; Professor Macbride, Principal of Magdalen Hall; Professor Daubeny; Professor Pusey; Mr. Michell; Mr. Gordon; Mr. Mansell.) Your Committee,—having taken into consideration, in connexion with the subject referred to them, two letters addressed by the Rev. F. Temple to the Master of Pembroke, a pamphlet on Middle-Class Education published by T. D. Acland, Esq., and numerous memorials to the Hebdomadal Council (which are appended to this Report),—and having had the advantage of a conference with the Rev. F. Temple and the Rev. H. W. Bellairs, two of her Majesty's Inspectors of Schools who attended by permission of their superiors, and with Mr. Acland,—report as follows:

"1. It appears a duty that the University should answer to the call made upon it, and endeavour to extend its beneficial influence to the education of classes now for the most part beyond its reach.

"2. For the instruction of the children of the poor, Parliament makes large provision. The Universities exercise a great influence, directly or indirectly, on the training of a considerable portion of the young in the upper classes.

"3. As to those, however, whose parents occupy an intermediate position, nothing is done, perhaps nothing could be done beneficially, by the State; and there is little connexion between them and the Universities.

"4. But it is desirable that the efforts of good teachers in the schools frequented by this class of pupils should be guided, encouraged, and pointed out to public approbation; and, on the other hand, that parents should be put on their guard against incapacity and false pretences.

"5. It is desirable that the industry and talent of the boys should be stimulated by the prospect of attaining distinction of a higher character than can be gained in a small school; that promising youths should be pointed out to employers; and that all the talent of the country should be directed into the course in which it can be most effectively employed.

"6. A well-digested and well-administered system of voluntary periodical examinations and distinctions is calculated to effect these objects.

"7. Administered by the Universities, whose motives are above suspicion,

* Middle-Class Education. Scheme of the West of England Examination and Prizes for June, 1857. With Introductory Remarks addressed to Members of the Universities. By T. D. Acland, Esq. London: Ridgway. 1857. Price 1s.

and whose command of men of ability is very great, such a system would, it may be hoped, obtain the confidence of the country, and would produce all the fruits which may be fairly expected from it.

"8. It appears to your Committee, that there should be two Examinations annually, one for boys under the age of fifteen, the other for boys under the age of eighteen; the former to secure soundness in the elementary training, without which more advanced education cannot be satisfactorily carried on; the latter to prove that the candidates are well fitted for the situations in life into which young men usually enter about that age, or for continuing their studies with advantage.

"9. The examination would probably be holden in the Long Vacation.

"10. Oxford itself would offer many advantages for the purpose; but it might be desirable that the examination should be conducted simultaneously in other considerable places, by an examiner or examiners deputed for the purpose. The papers should be everywhere the same.

"11. There should be an examination in the rudiments of religion, suited to the character of the University and to the age of the candidates: but not in cases where objections are signified by parents or guardians.

"12. The distinctions given at the first examination (beyond the certificate of the examiners) need not be numerous or great. At the second there should be a distribution of the candidates into classes according to merit; and some certificate, attested by the Vice-Chancellor, given to all who pass; showing their position in the award of the examiners, and conferring some title marking the connexion of the possessor with the University of Oxford.

"13. It is difficult to find a title of this kind wholly free from objection. Perhaps that of Associate in Arts (A.A.) of the University of Oxford, suggested by Mr. Temple, would be as good as any.

"14. It is impossible to foresee the number of candidates who may be expected annually to come forward: and therefore it appears inexpedient to propose any definite arrangements. Nor does it seem advisable to fix by legislation the system of examination in any detail, or the precise classification of the successful candidates.

"15. Your Committee is of opinion, that the best course for the University to pursue, is to appoint a delegacy of persons entitled to its confidence, with power to nominate such a number of examiners as may be from time to time required, to prescribe the subjects of examination, to frame a system of honours, to fix upon the times and places of examination, and to determine the salaries of the examiners and other officers who may be required. The experience of the delegates would probably enable the University at no distant period to frame a more definite statute.

"16. The delegacy should consist of the Vice-Chancellor, the Proctors, and eighteen other members; six chosen by the Hebdomadal Council from its own body; six by Congregation; and six added by the Vice-Chancellor and Proctors. The first delegacy to last for three years.

"17. The delegacy should be bound to make an annual report to the University.

"18. The system ought, in the opinion of your Committee, to be self-supporting; but should not be permitted to yield any profit. There is reason to believe that a fee of 5*s.* from every candidate for the first examination, and of 1*l.* from every candidate for the second examination, would be sufficient. The delegates ought, however, to be entrusted with the power of varying these sums.

"19. The Committee has reason to believe that the proposed scheme of examination has been favourably received by distinguished persons in the University of Cambridge. Should both Universities arrive at the conclusion that it is their duty to adopt it, the country will be well served by their har-

monious, but independent, action. Your Committee would not in such a case propose any geographical division of labour, or any system of combined examination. The choice should be left to the convenience or inclination of the candidates or their parents.

"20. Your Committee recommend that a statute, in accordance with these suggestions, should be presented to Congregation and Convocation." *

Appended to this Report are numerous memorials from all parts of the kingdom in favour of the scheme, not the least important of which is one signed by a large number of lecturers attached to the London schools of medicine.

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